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# PASEO de SUSANA SHORE PROTECTION TERRITORY OF GUAM



## FINAL detailed project report AND ENVIRONMENTAL ASSESSMENT



**US Army Corps  
of Engineers**  
Honolulu District

**NOVEMBER 1983**

**PASEO DE SUSANA SHORE PROTECTION  
TERRITORY OF GUAM**

**MAIN REPORT**

**Revised 1 June 84**

## SYLLABUS

The purpose of this report is to document the feasibility, the impacts, and the technical features of potential shore protection measures for Paseo de Susana Park, Agana, Territory of Guam. The final Environmental Assessment and Finding of No Significant Impact (FONSI) which describes the impacts of the final alternative plans is included. This report in combination with the construction plans and specifications will serve as the authorizing document for construction upon approval by the Chief of Engineers.

The scope of the report included identification of the shoreline erosion problem, examination of various alternative plans, and evaluation of plans in terms of technical, economic, environmental, and social acceptability. The evaluation and plan selection was guided by the national objective of National Economic Development (NED) in accordance with the U.S. Water Resources Council (WRC) regulations for Federal water and related land development projects. The shoreline erosion problem at Paseo de Susana Park was attributed to storm wave attack on the shore.

The recommended plan of improvement consists of a total of 1470 feet of rock revetment in combination with 970 feet of beach-type fill and vegetation for a total protected shoreline length of 1470 feet.

The total first cost of the project is estimated to be \$886,000, of which \$560,000 will be the Federal share and \$326,000 will be the non-Federal share. The average annual benefits from the project will be \$283,000, yielding a benefit-to-cost ratio of 3.0.

DEPARTMENT OF THE ARMY  
U.S. ARMY ENGINEER DISTRICT, HONOLULU  
FORT SHAFTER, HAWAII 96858-5440

PASEO DE SUSANA  
SHORE PROTECTION  
TERRITORY OF GUAM

FINAL  
DETAILED PROJECT REPORT  
AND  
ENVIRONMENTAL ASSESSMENT

NOVEMBER 1983

REVISED 1 JUNE 84

PASEO DE SUSANA SHORE PROTECTION  
AGANA, GUAM

FINAL

DETAILED PROJECT REPORT  
AND  
ENVIRONMENTAL ASSESSMENT

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## 1. INTRODUCTION

### 1. PURPOSE

The purpose of this study was to determine the need for and feasibility of providing shore protection measures at the Paseo de Susana Park in Agana, Territory of Guam.

### 2. STUDY AUTHORITY

This study was accomplished under the authority provided by Section 103a of the River and Harbor Act of 1962, as amended. Pertinent excerpts from the authority are included in Appendix A.

The Paseo de Susana Shore Protection Study was initiated following a written request from the Governor of Guam dated 11 July 1979. Based upon this request, a reconnaissance was completed by the U.S. Army Corps of Engineers, Honolulu District on 12 February 1982. Preparation of a detailed project study for the Paseo de Susana Park was approved by the Chief of Engineers on 23 February 1982. Initiation of the detailed project report was begun in April 1982.

### 3. STUDY AREA AND LOCATION

Guam is a territory of the United States, and is the largest and southernmost of the Mariana Islands chain. Other major islands within the chain include Saipan, Tinian, and Rota. The island of Guam encompasses 209 square miles and is approximately 30 miles long and 4 to 8.5 miles wide. Guam is located about 3,800 miles west of Honolulu and 1,500 miles south of Tokyo. United States military reservations occupy most of the northern half of the island. Major civilian population centers are concentrated in central Guam and with scattered communities along the southern coastline regions.

The Paseo de Susana public park is a man-made peninsula formed from the rubble of the city of Agana after World War II, and is located adjacent to the Agana boat basin. This 33-acre landfill extends seaward approximately 1,500 feet from the natural shoreline to within 300 feet of the reef fringing Agana Bay. The park is located approximately midway between Adelup Point and Oca Point along the Agana Bay shoreline. The project study area and location are shown on Figure 1. Recreational features associated with the study site are shown on Figure 2.

### 4. SCOPE OF THE STUDY

This study identified and evaluated the problems and needs associated with providing shore protection measures at the Paseo de Susana Park, and the impacts upon the overall environmental (economic, social, cultural, and recreational) resources of the area. Alternative plans were developed, and the costs and benefits associated with implementing these measures were evaluated.

Studies conducted included site investigations, archaeological and cultural studies, hydrographic and topographic surveys, geologic, foundations and materials investigations, fish and wildlife studies, oceanographic and meteorological studies, engineering design, economic evaluations, and environmental assessment.

## 5. STUDY PARTICIPANTS AND COORDINATION

The U.S. Army Corps of Engineers, Honolulu District, was responsible for conducting and coordinating the overall study and preparing the study report. Studies and investigations were performed with the assistance of government agencies (Federal, Territorial, and local). Community groups and private interests were contacted during the study to help identify study concerns, to obtain pertinent study information, and to develop and evaluate alternative plans. A list of those contacted, and the Public Involvement Program are presented in Appendix B.

## 6. REPORT PREPARATION

This document consists of a main report and a series of appendices. The main report is a self-contained document which describes the planning process and includes the environmental assessment. The appendices contain technical and detailed information and background data to support the information contained in the main report.

Appendix A, Plan Formulation Criteria and Compliance Reports, contains specific information regarding the study authority, legislative requirements, planning criteria and constraints, and local cooperation requirements that contribute to the plan formulation process of the study. Also included in this appendix are the evaluation reports required by Executive Order 11988, Section 404 of the Clean Water Act, and the Coastal Zone Management Act.

Appendix B, Public Involvement Program, describes the public involvement program and contains pertinent correspondence received during the study and evaluation period.

Appendix C, Fish and Wildlife Coordination, contains the U.S. Fish and Wildlife Service report prepared in accordance with the Fish and Wildlife Coordination Act of 1958 (Public Law 85-624), and endangered species coordination with the U.S. Fish and Wildlife Service and U.S. National Marine Fisheries Service.

Appendix D, Engineering Investigations and Design Analysis, contains the engineering analyses and data relevant to the design of the proposed shore protection improvements. This appendix also provides information concerning geology, foundations and materials investigations, and cost estimates.

Appendix E, Economic Analysis, contains the economic background, data, and analyses for determining the benefits and costs associated with each alternative plan.

## 7. PRIOR STUDIES

The U.S. Army Corps of Engineers, Honolulu District, completed a negative reconnaissance report on erosion along the western shoreline of the Paseo de Susana Park in October 1972. The report recommended no action until completion of the adjacent Agana small boat harbor and study of its effect upon the shoreline erosion.

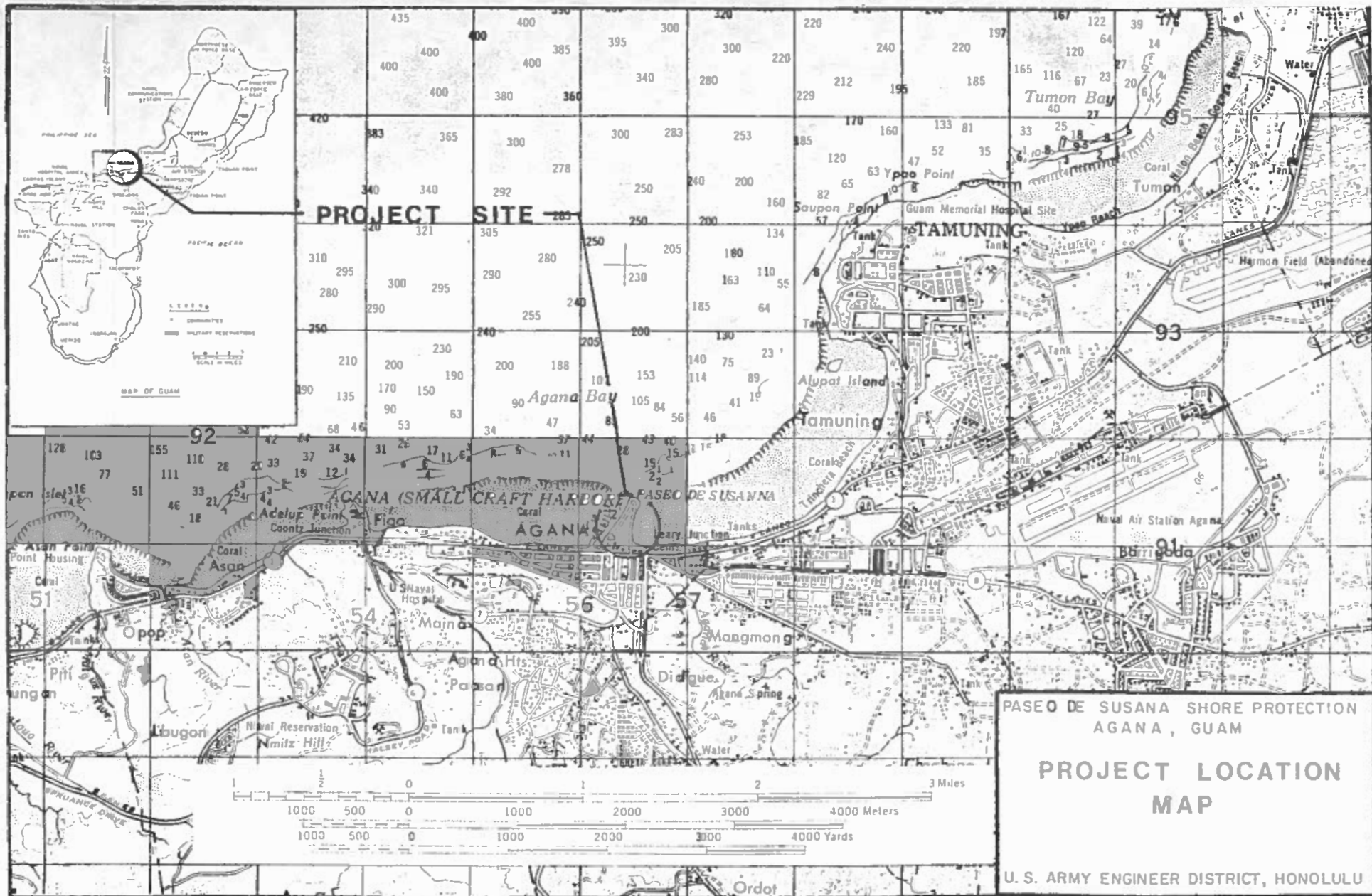


FIGURE 1

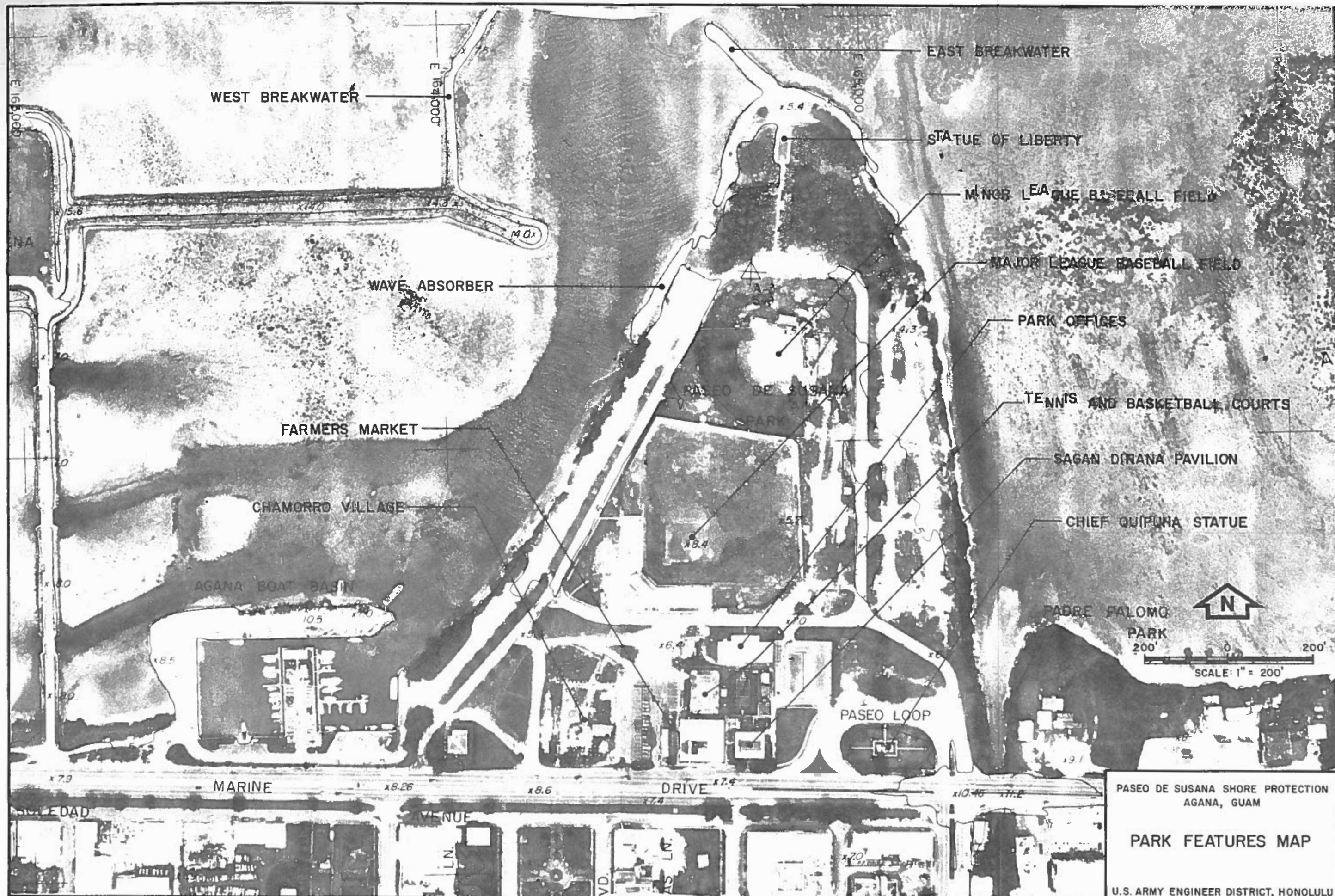


FIGURE 2

## II. PROBLEM IDENTIFICATION

### 1. PURPOSE

The purpose of this section is to define the study area and the problems to be addressed in the study. This includes describing the base conditions, identifying public concerns, establishing planning criteria, and analyzing the problems. Public concerns which relate to water and related land resource problems are identified and then refined, based on national and local policies.

National planning policies are prescribed by the Water Resource Council's Principles and Guidelines, the National Environmental Policy Act of 1969 (Public Law 91-190), Section 122 of the River and Harbor and Flood Control Acts of 1970 (Public Law 91-611), the Water Resources Development Act of 1974 (Public Law 93-251), the Clean Water Act of 1977 (Public Law 95-217), and the Corps of Engineer's policy guidelines (ERs).

To help determine resource management 1/ problems, the base condition of the study area is initially defined. The base condition is the existing economic, social, and environmental characteristics of the area. Future conditions are then projected and analyzed to determine the "most probable future" 2/ which would prevail over the area without any changes to existing resource management plans. This analysis describes the "without condition" criterion. Planning objectives 3/ are then formulated based on the problems and needs of the area related to the "without condition" criterion.

### 2. NATIONAL OBJECTIVES

The Water Resource Council Principles and Guidelines (P&G) for planning water and related land resources defines the national objective of national economic development as a means of measuring the effectiveness of possible solutions. The national economic development (NED) objective is achieved by increasing the value of the nation's output of goods and services, and improving national economic efficiency.

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1/ "Resource management" involves the development, conservation, enhancement, preservation, and maintenance of water and related land resources to achieve the goals of society, expressed nationally and locally.

2/ "Most probable future" is the projection of basic demographic, economic, social, and environmental parameters, which is used as the basis for defining the "without condition" and the planning objectives for a particular study.

3/ "Planning objectives" are the national, state, and local, water and related land resource management needs (opportunities and problems) specific to a given study area that can be addressed to enhance National Economic Development.

The NED contributions are maximized during the formulation of alternative plans. For any plan to be considered for implementation, the total beneficial contributions accruing from the project must exceed the total adverse impacts or costs of the project. The P&G also require that the impacts of a proposed action be measured in terms of environmental quality (EQ), regional economic development (RED), and other social effects (OSE). Contributions to the EQ account provide for the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems in the study area. Contributions to the RED account are determined by establishing a proposal's effects on a region's income, employment, population, economic base, environment, and social development. Contributions to the OSE account are determined by establishing a proposal's effects on real income, security of life, health and safety, education, cultural and recreational opportunities, and emergency preparedness.

### 3. PROFILE OF EXISTING BASE CONDITIONS

The cultural, physical, environmental, and economic characteristics of Guam are briefly described below. The appendices contain more detailed descriptions relevant to the planning and design of shore protection improvements.

#### a. History and Culture.

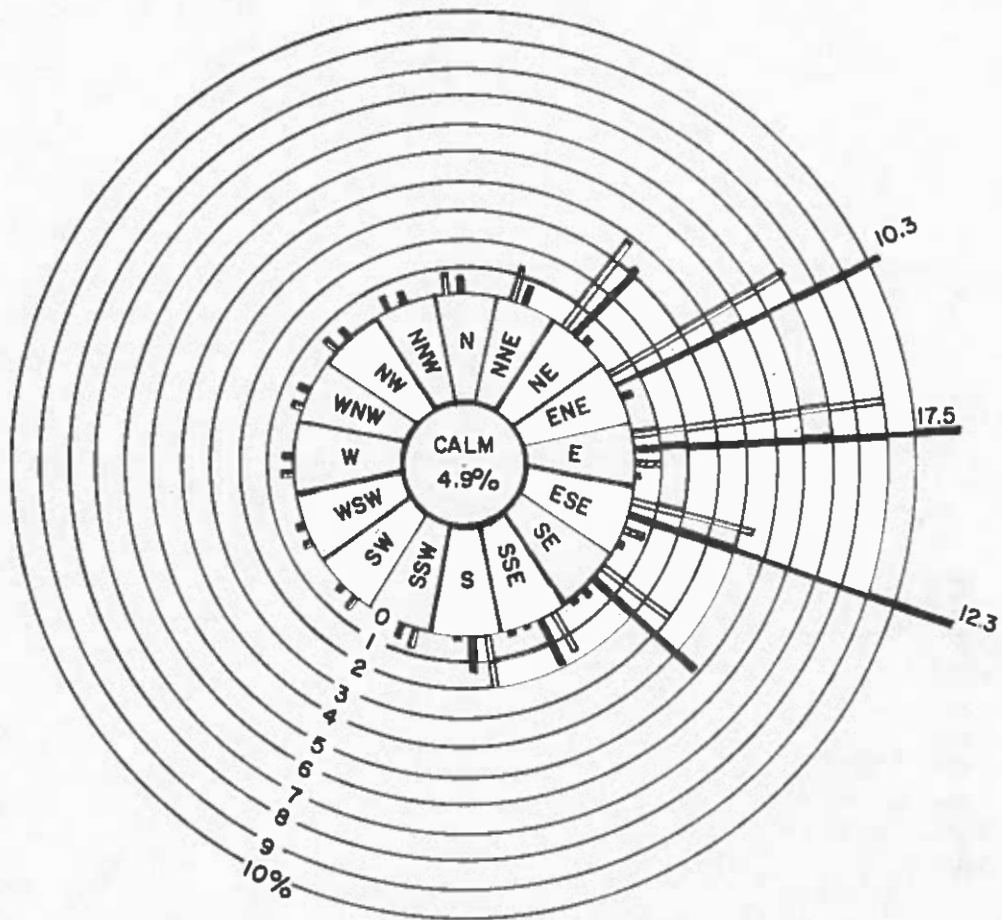
The ancestors of the present-day Guamanians, called Chamorro, are believed to have come originally from Southeast Asia, arriving in Guam at least as early as 1500 B.C. Ferdinand Magellan's discovery of Guam in 1521 marked the beginning of 375 years of Spanish influence on Guam society and culture. Following the Spanish-American War of 1898, the island was ceded to the United States, and placed under the administrative control of the U.S. Navy until 1950. Agana has served as the island's capital and principal population center for the entire historic period. The city was destroyed by American forces in 1945 while retaking the island from Japanese control. The people moved out into the countryside in the postwar years. Rubble from the city was pushed onto the reef flat and former mouth of the Agana River to form the Paseo de Susana peninsula and park.

#### b. Physical and Environmental Setting.

(1) Physical Features. Guam is the southernmost major island in the Marianas chain, a 500-mile-long archipelago in the Western Pacific. It is approximately 30 miles long, ranges from 4 to 8.5 miles in width, and has a land area of about 209 square miles. The island is approximately 3,800 statute miles west of Hawaii. The Paseo de Susana Park is a man-made peninsula formed from Agana's rubble after World War II. The park is situated on an extensive fringing reef adjacent to the Agana Boat Harbor.

(2) Climate. The island of Guam has a tropical climate, with warm and humid conditions throughout the year. Average temperatures on Guam range between 75°F and 86°F, and the humidity varies between 75 percent and 82 percent. There are two distinct seasons, defined by variations in wind and rainfall. The dry season extends from January through May, and the wet season from July through November. Easterly trade winds occur throughout the year,

**SURFACE WIND DIAGRAM**  
**AGANA FIELD FLEET WEATHER CENTRAL**  
**GUAM, MARIANA ISLANDS**



**LEGEND**

- 1-6 KNOTS
- 7-16 KNOTS
- 17-21 KNOTS
- OVER 21 KNOTS

CONVERSION: 1 KNOT = 1.1516 MPH

10% = TOTAL % OF THE YEAR

**PERIOD OF RECORD**

1945-1967

**SOURCE**

NATIONAL WEATHER SERVICE  
 HONOLULU, HAWAII  
 DATA COMPILED BY U.S. AIR FORCE  
 ENVIRONMENTAL TECHNICAL  
 APPLICATION CENTER,  
 ASHEVILLE, N.C.

PASEO DE SUSANA SHORE PROTECTION  
 AGANA, GUAM

**SURFACE WIND DIAGRAM**

U.S. ARMY ENGINEER DISTRICT, HONOLULU

but are dominant during the dry season. From July through October, winds become variable and the frequency of occurrence of typhoons increases. The mean annual rainfall on Guam varies from less than 90 inches on the coastal plains, to over 110 inches on the higher mountain areas.

(3) Astronomical Tides. The tides on Guam are semi-diurnal with pronounced diurnal inequalities. Tidal data from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, shows that the mean tide range is 1.7 feet, and the diurnal (spring tide) range is 2.4 feet. The nearest tidal gauge to the study site is at Apra Harbor, Guam, approximately 13 miles distant, and the data from this gauge is considered reasonably applicable to the study area. Tidal data for the 19-year period between 1949-1967 at Apra Harbor is as follows:

|                        | <u>Feet</u> |
|------------------------|-------------|
| Highest tide observed  | 3.3         |
| Mean higher high water | 2.4         |
| Mean high water        | 2.3         |
| Mean tide level        | 1.45        |
| Mean sea level         | 1.4         |
| Mean low water         | -0.6        |
| Mean lower low water   | -0.0        |
| Lowest tide observed   | -1.9        |

All elevations in this report are referenced to mean lower low water (MLLW) datum.

(4) Terrestrial Biota. Terrestrial flora within the Paseo de Susana Park consists primarily of coconut palms (Cocos nucifera), grasses (Naupaka sp.) and false ironwood (Casuarina equisetifolia). There are no listed or candidate threatened or endangered terrestrial species in the project area. The project area contains the usual exotic species of urban birds and mammals. Dogs, cats, and rats in the area may be attracted to the area by the nearby "farmers market."

(5) Marine Biota. Estuarine species inhabit the Agana River which discharges at the eastern base of the park peninsula. Hook and line fishing for jacks, juvenile rabbit fish, and other species along the Agana Marina channel during spring, summer, and fall is the most intense of any location on Guam. The Paseo also provides easy access to the heavily-fished reef flat in East Agana Bay. According to the Guam Division of Fish and Wildlife, the nearshore site of the Agana Small Boat Harbor is not a highly productive coral area; however, areas 300 feet shoreward of the reef front do have good growths of live coral in pockets.

(6) Geology. The islands of the Marianas chain are of volcanic origin, and represent the peaks of volcanic ridges. The island of Guam is the largest in the chain. Its geologic and topographic features essentially divide the island into northern and southern sections. The northern section is composed of a broad limestone plateau fringed by steep coastal cliffs. The soil on the northern limestone plateau is highly permeable. Streams are absent, as rainfall drains downward to numerous sinkholes and fissures forming

a basal freshwater lens. The southern portion of the island is mountainous, with broad, relatively impervious areas of volcanic rock marked by deeply incised valley perimeters and floors.

(7) Seismicity. The island of Guam is situated within a seismically active zone and is classified as a seismic zone 3. Many earthquakes of low and moderate magnitude occur throughout the year.

c. Human Resources.

(1) Population. Guam's population since the official census began in 1901 is shown in Table 1.

TABLE 1. HISTORICAL POPULATION OF GUAM

| <u>Year</u> | <u>Total<br/>Population</u> |
|-------------|-----------------------------|
| 1901        | 9,676                       |
| 1910        | 11,806                      |
| 1920        | 13,275                      |
| 1930        | 18,509                      |
| 1940        | 22,290                      |
| 1950        | 59,498                      |
| 1960        | 67,044                      |
| 1970        | 84,996                      |
| 1980        | 105,816                     |

Source: U.S. Department of Commerce, Bureau of Census and the Guam Department of Commerce.

Projections for Guam envisage a continued growth for the foreseeable future. Projections by the Guam Department of Commerce estimate a population expansion to 136,200 by the year 2000. An extension to the year 2030 assumes a 1/4 of one percent annual growth. The total population projection assumes a constant of 5,000 for nonimmigrant aliens and 20,000 for military personnel and dependents. Population projections for Guam are shown in Table 2. The Paseo and adjacent reef flats and beaches attract people from nearly all the island's districts, especially the heavily-populated area of central Guam.

TABLE 2. GUAM POPULATION PROJECTION

| <u>Year</u> | <u>Total<br/>Population Projection</u> |
|-------------|----------------------------------------|
| 1990        | 119,000                                |
| 2000        | 136,000                                |
| 2010        | 140,000                                |
| 2020        | 143,000                                |
| 2030        | 147,000                                |
| 2035        | 149,000                                |

#### d. Economic Development.

Statistics on gross island product are not available for Guam. The gross business receipts, an indicator of gross island product, show a remarkable average increase of 21 percent per annum between 1963 (\$82.9 million) and 1973 (\$563 million). This trend was hampered in 1975 and 1976 by the world recession and typhoon disasters. In 1977 the increase was only 6 percent. By 1978 the increase had climbed to 17 percent per annum. Once, mostly dependent on the military, local government, and the construction industry, the emergence of the tourist industry and related activities has broadened Guam's economic base for future growth. Table 3 shows the growth rate of major industries on Guam between 1970 and 1980.

TABLE 3. GROWTH RATE OF MAJOR INDUSTRIES ON GUAM, 1970-1980

|                                   | <u>1970 Earnings<br/>or Value<br/>(\$ Millions)</u> | <u>1980 Earnings<br/>or Value<br/>(\$ Millions)</u> | <u>1970 - 1980<br/>Average Annual<br/>Growth (Percent)</u> |
|-----------------------------------|-----------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------|
| Gross Sales                       |                                                     |                                                     |                                                            |
| Retail                            | 91.1                                                | 352.6                                               | 14.0                                                       |
| Wholesale                         | 29.8                                                | 92.6                                                | 7.7                                                        |
| Manufacturing                     | 6.3                                                 | 340.3                                               | 52.8                                                       |
| Agriculture                       | NA                                                  | 3.7                                                 | -                                                          |
| Services                          | 26.7                                                | 141.6                                               | 15.7                                                       |
| Transportation                    | 0.1                                                 | 24.4                                                | 89.6                                                       |
| Insurance, Real<br>Estate Finance | 19.7                                                | 75.9                                                | 17.0                                                       |
| Foreign Trade                     |                                                     |                                                     |                                                            |
| Exports                           | 5.8                                                 | 61.0                                                |                                                            |
| Imports                           | 96.4                                                | 544.2                                               |                                                            |
| Construction                      | 53.1                                                | 80.6                                                | 9.7                                                        |
| Government                        |                                                     |                                                     |                                                            |
| Local                             |                                                     |                                                     |                                                            |
| Revenue                           | 17.7                                                | 128.7                                               | 7.7                                                        |
| Expenditure                       | 48.9                                                | 140.1                                               | 11.9                                                       |

Source: Guam Annual Economic Review 1982, Department of Commerce, Government of Guam.

Guam experienced a high level of employment since World War II and had no unemployment problems until recently. However, increasing immigration and dependence on relatively cheap imported (alien) labor are changing the employment picture and may cast the island into a situation of severe unemployment in the future. Trends toward unemployment are revealed in total employment increases of 15 percent in 1972 and again in 1973 but only 2 percent in 1974. The May 1975 unemployment statistics show a rate of 8.3 percent and increased a year later to 13.3 percent in May 1976. Following this period,

the disaster of Typhoon Pamela raised the unemployment significantly. Total paid employment on the payrolls of all licensed business establishments and governmental agencies during first quarters of March 1979, 1980, and 1981 is summarized by industry in Table 4.

TABLE 4. EMPLOYMENT BY INDUSTRIES AND PERCENT DISTRIBUTION  
(MARCH 1979, 1980, 1981)

| <u>Industry</u>                   | <u>Total Employment</u> |             |             | <u>Percent</u><br><u>Distribution</u> |
|-----------------------------------|-------------------------|-------------|-------------|---------------------------------------|
|                                   | <u>1979</u>             | <u>1980</u> | <u>1981</u> | <u>1981</u>                           |
| Agriculture                       | 100                     | 200         | 100         | 0.25                                  |
| Construction                      | 4,900                   | 2,300       | 2,100       | 5.21                                  |
| Manufacturing                     | 1,200                   | 1,100       | 1,200       | 2.98                                  |
| Transportation & Public Utilities | 2,700                   | 2,700       | 2,700       | 6.70                                  |
| Wholesale & Retail Trade          | 6,800                   | 6,700       | 6,400       | 15.88                                 |
| Finance, Insurance & Real Estate  | 1,200                   | 1,200       | 1,200       | 2.98                                  |
| Service                           | 8,400                   | 9,000       | 9,700       | 24.07                                 |
| Government                        |                         |             |             |                                       |
| Federal                           | 6,600                   | 6,600       | 6,400       | 15.88                                 |
| Local                             | 9,600                   | 9,300       | 10,500      | 26.05                                 |
| TOTALS                            | 41,500                  | 39,100      | 40,300      | 100.00                                |

Source: Annual Economic Review (Statistical Abstract), Guam 1982 Economic Research Center, Department of Commerce, Government of Guam, August 1982.

Government, construction and wholesale and retail trade employ about 63 percent of the total labor force. Government is the largest employer on the island and will continue to be a major factor in the economy of Guam. Employment by the local government is expected to increase with population and needs of an expanding economy.

The construction industry employed 6 percent of the island's labor force in 1981.

The wholesale and retail trade industry employs more than 19 percent of the island's labor force. Guam's natural resources for industrial development are limited, thereby making the economy service-oriented. This service is expanding to accommodate the influx of visitors and is evident by the growing number of new businesses.

The phenomenal growth of the visitor industry since 1970 as shown in Table 5 is attributed to the rising Japanese investment in Guam. In 1981, some 79 percent of all visitors were from Japan. To accommodate the visitors, hotels, especially around the Tumon Bay area, were constructed at an accelerated rate, with capital provided primarily by Japanese investors. The number of visitors to Guam is expected to grow. Continued development of the visitor industry

will have a definite impact on related services, both in the private and public sector. This industry appears to have the greatest potential for growth. Studies indicate that nearly every Japanese tourist and many of the others visit the Paseo at least once during their visit to Guam.

TABLE 5. TOURIST AND VISITOR ARRIVALS AND ESTIMATED EXPENDITURES  
(1960 - 1981)

| <u>Year</u> | <u>Tourist 1/</u> | <u>Visitor 1/</u> | <u>Estimated Expenditure</u> |
|-------------|-------------------|-------------------|------------------------------|
| 1960        | 200               | 3,500             | --                           |
| 1965        | 500               | 3,000             | \$600,000                    |
| 1970        | 46,581            | 73,723            | 15,000,000                   |
| 1971        | 84,885            | 119,174           | 30,000,000                   |
| 1972        | 139,833           | 185,399           | 50,000,000                   |
| 1973        | 187,471           | 241,146           | 90,000,000                   |
| 1974        | 233,909           | 260,568           | 130,000,000                  |
| 1975        | 128,241 <u>2/</u> | 239,695 <u>2/</u> | 180,000,000                  |
| 1976        | 105,954           | 201,344           | 102,000,000                  |
| 1977        | 150,118           | 240,467           | 120,000,000                  |
| 1978        | 148,523           | 231,975           | 116,000,000                  |
| 1979        | 173,102           | 264,326           | Not Available                |
| 1980        | 203,784           | 291,129           | 118,000,000                  |
| 1981        | 232,808           | 312,862           | 190,000,000                  |

Source: Economic Research Center, Department of Commerce, Government of Guam; Guam Visitors Bureau (GVB).

1/ Tourists are travelers arriving for pleasure. Visitors are all people entering Guam whose permanent address is outside of Guam.

2/ Data not available from September to December 1975.

#### e. Cultural Resources.

There are no historical/cultural sites listed on the Guam or the Federal Register of Historic Places for the Paseo de Susana project area. Because the Paseo de Susana Park is a man-made promontory built principally of rubble from war-ravaged Agana atop a corraline material base, there are no intact historic sites or features remaining in the study area except for one Japanese pillbox in the southwest corner of the peninsula. The rubble may contain information on Agana's past; however, it is out of context and is not considered significant. Modern cultural features erected in the park consist of a reduced-scale replica of the Statue of Liberty at the northern tip of the peninsula, a memorial to fallen members of the U.S. Marine Corps near Marine Drive, and a statue of the ancient Chamorro chieftan Quipuha.

#### f. Recreational Resources.

The Paseo de Susana Park is a popular recreational site for local residents, as well as tourists, to engage in various sports activities such as baseball, tennis, volleyball, soccer, and field hockey. The park also has a youth center and a picnic area, and is a popular fishing site for shoreside fishermen being seasonally one of the most heavily fished locations on Guam. Many surfers use this park for access to surfing sites adjacent to the Agana Harbor entrance channel, just off the tip of the park. Because of the anticipated heavy influx of tourists and the expanding resident population, every effort must be made to preserve and protect this valuable outdoor resource. Due to its ideal location, it will continue to provide a major portion of the recreational opportunities to the people of Guam.

#### g. Land Use.

Agana is the government and commercial trade center of Guam. Governmental and commercial land uses typify most of downtown Agana. Agana's share of the island population has fallen from 45 percent (10,394) in 1940 to less than one percent (896) in 1980. Much of the former residential area remains undeveloped today because of land ownership disputes. Although the population of Agana is expected to expand to 2,550 persons by the year 2000, future land use is expected to remain in commercial and government activities. These will further emphasize the present-day role of Agana as a day-time employment center. Paseo de Susana Park especially serves the daytime workers in downtown Agana, as well as the permanent residents of Agana, Agana Heights, Sinajana, and Mongmong-Toto-Maite. The park can also be considered the recreational center of Guam, offering the island's largest and most modern baseball stadium, a large fairground and the singly most-popular fishery (see also Appendix E).

#### 4. "WITHOUT CONDITION" PROFILE

If no Federal action is taken to provide shoreline protection improvements, the lack of adequate protection will further reduce valuable park space and will constrain full recreational use of the ocean, as well as the park's resources for fishing, surfing, picnicking, and other activities. The Paseo de Susana Park will continue to be a popular site among island residents, and attract nearly every tourist as well. Although there are other parks on the island, the Paseo de Susana Park, because of its centralized location within the urban waist of Agana, must be able to cope with the anticipated increase in demand for open seaside recreational space within central Guam. Since there is limited park space within Agana, the Paseo de Susana Park will continue to be the focal point of recreational activities. In order to avoid disruption of any of these activities, shoreline areas must be protected in order to prevent further reduction of valuable park space.

#### 5. SHORELINE PROBLEMS AND NEEDS

Erosion is occurring along the eastern and western shorelines of the Paseo de Susana Park. Up to approximately 2,500 feet of the park shoreline has eroded as much as 40-50 feet inland at various locations within the park since the original construction of the park landfill after World War II. The Office of the Governor of Guam, in a letter dated 11 July 1979, requested that an assessment of the erosion at the Paseo de Susana Park be completed, and a structural remedy be formulated to prevent further erosion of the park.

Field investigations for this study indicated that 500 feet along the east park shoreline and 970 feet along the west (Agana Harbor) shoreline are presently undergoing the severest erosion. Erosion of the east park tip appears to be due to its proximity to the reef fringing Agana Bay, while erosion of the west shoreline appears to be due to travel of storm waves up the Agana Harbor entrance channel. A detailed analysis of shoreline erosion at the park is included in Appendix D. Photographs of the affected shoreline are shown following this page.

## 6. SHORELINE HISTORY

The Paseo de Susana peninsula is composed principally of war rubble overlain with soil fill. Pre-World War Two photographs of old Agana reveal that the original shoreline was located approximately 100 yards north of Soledad Avenue, with the delta of the Agana River extending approximately 150 yards beyond the shoreline. The Agana River delta formed what is now the southwest quadrant of Paseo de Susana Park. The present location of Marine Drive and the southernmost part of the Paseo was intensively settled with small residences. A wharf-like structure apparently constructed in the late 1930's, was located in the present center of the Paseo. Immediately following the July 1944 invasion by U.S. forces, a new Agana River channel was dredged along the present western side of the Paseo, with the dredged material forming the base of the new peninsula. The eastern third of the Paseo appears to have been filled during the late 1950's or early 1960's.

Protective revetments for the Paseo de Susana Park were first constructed by the Navy at the tip of the park. Since this construction, an additional 250' long shoreline revetment has been placed along a portion of the western shoreline as a wave absorber for the U.S. Army Corps of Engineers Agana Harbor project. This revetment was constructed to minimize wave energy entering the entrance channel and berthing areas. This structure also serves to prevent further erosion of the existing shoreline and dampens any wave reflection from the shoreline. At the present time, there are no protective structures along the eastern shoreline of the park. At several locations within the park, large pieces of concrete and rusting metal from the rubble fill are exposed due to erosion of the shoreline.

## 7. PLANNING OBJECTIVES

The planning objectives for shore protection measures at the Paseo de Susana Park in Agana, Guam are based on the identification and analysis of shoreline erosion, environmental and human resources problems and needs. The following planning objectives were adopted to guide the formulation and evaluation of alternative improvement plans consistent with the Federal NED objective.

- a. Mitigate shoreline erosion at the Paseo de Susana Park at Agana, Guam.
- b. Enhance fishing, as well as other recreational and leisure opportunities for the people of Guam.
- c. Preserve and enhance the visual/aesthetic qualities of the park and shoreline.

P A C I F I C

O C E A N

REEF EDGE

REEF EDGE

WEST BREAKWATER

EAST BREAKWATER

SEWAGE  
TREATMENT  
PLANT

AGANA SMALL  
BOAT HARBOR

CAUSEWAY  
TO STP

PASEO DE SUSANA  
PARK

AGANA RIVER

TRINCHERA BEACH

N

○ APPROXIMATE LOCATION  
OF PHOTOGRAPH

400 200 0 400 800

SCALE IN FEET

PASEO DE SUSANA SHORE PROTECTION  
AGANA, GUAM

PHOTOGRAPH LOCATIONS

U S ARMY ENGINEER DISTRICT, HONOLULU



Photograph #1 East park shoreline near  
Station 3+00 looking north.



Photograph #2 East park shoreline near  
Station 4+50 looking north.



Photograph #3 East park shoreline near  
Station 10+00 looking north.



Photograph #4 East park shoreline near  
Station 9+00 looking south.



Photograph #5 West park shoreline near  
Station 7+00 looking north.



Photograph #6 West park shoreline near  
Station 3+00 looking south.



Photograph #7 West park shoreline near  
Station 2+00 looking south.



Photograph #8 West park shoreline near  
Station 1+00 looking north.

### III. FORMULATION OF ALTERNATIVE PLANS

#### 1. FORMULATION AND EVALUATION CRITERIA

This section of the report is directed toward the development and evaluation of alternative measures to resolve the problems and needs of the study area and to fulfill the planning objectives defined in the previous section. The initial step in the formulation process is the identification of a broad range of institutional and technical measures available to resolve problems and needs. These available measures are then evaluated to formulate a plan which best addresses or resolves the present and future problems and needs of the study area. The formulation and analysis of alternative solutions to achieve the planning objectives was based on the Water Resources Council's Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G). The evaluation and assessment of economic, social, and environmental effects also followed the guidelines of Section 122 of the River and Harbor Act of 1970 (Public Law 91-611) and the National Environmental Policy Act of 1969 (NEPA), as well as pertinent Corps of Engineers regulations and guidelines. The formulation and evaluation of alternative plans of improvement was guided by the following technical, economic, and environmental criteria.

##### a. Technical Criteria.

The following technical criteria were established for plan formulation:

(1) Alternative measures should protect the shoreline of the study site from further land loss due to erosion.

(2) Alternative measures should be compatible with the Government of Guam's present and future uses of the Paseo de Susana Park.

(3) Alternative measures should be compatible with the operation of the adjacent Agana Harbor.

(4) Alternative measures should be designed for a 50-year project life.

##### b. Economic Criteria.

The following economic criteria were established for plan formulation:

(1) Quantifiable benefits should exceed project economic costs.

(2) Alternatives should be developed such that each plan will have an excess of benefits over costs, or net benefits is maximized. The best plan economically (NEU Plan) is the one with the greatest net benefits. Also, non-quantifiable or intangible benefits as well as costs should be thoroughly considered and accounted for.

##### c. Environmental and Social Criteria.

The following environmental and social criteria were established for plan formulation:

(1) Alternative measures should minimize degradation of the visual and aesthetic qualities of the shoreline.

(2) Alternative measures should not adversely affect the social well-being, health, or safety of park users.

(3) Alternative measures should protect and enhance the water quality and fish and wildlife resources of the study area.

## 2. PRELIMINARY SCREENING OF POSSIBLE SHORE PROTECTION MEASURES

A wide range of possible nonstructural and structural solutions or measures is available to manage or prevent shoreline erosion. These measures are identified and described with discussion of the applicability and viability of these measures to resolve the specific problems and meet the particular needs of the study area.

### a. Nonstructural Measures.

(1) No Action. Although "no action" is not truly a management measure, it is discussed under the nonstructural category as a management option for erosion control of the study area. "No action" is interpreted for the purposes of this report as "no action by anyone," or leaving the existing situation unchanged.

The "no-action" alternative is not considered an acceptable or viable solution to the problems and needs of the study area since it does not solve any problems nor fulfill identified needs of the study area. Under this measure, the shoreline of Paseo de Susana Park would continue to erode, resulting in further loss of park lands.

(2) Vegetative Barriers: In order to successfully implement this measure, the shoreline would have to be specially prepared for seeding or planting. The type of vegetation planted or seeded would have to be tolerant of recurring salt water inundation, in order to quickly develop a sufficient amount of root biomass to resist erosive and physical damage due to wave action.

This measure may be considered an acceptable alternative for shorelines not under continued wave action, such as the Agana Harbor shore of the park. Vegetative barriers are not sufficient to protect the shore from anticipated overtopping waves and can only be considered a partial solution or a measure to be used in conjunction with other measures. Consequently, maintenance of a vegetative barrier must incorporate complete reconstruction after major storms, such as typhoons. Maintenance of this measure under these conditions can be considered a periodic nourishment analogous to beach replenishment.

(3) Shoreline Management: Shoreline management at Paseo de Susana Park would involve planning for shoreline uses which would be compatible with the recognized erosion risk. Open-space park use is considered compatible with such recognized risk, however, under shoreline management, a setback zone would be established along the shoreline, in which no damageable structures would be constructed. All future damageable structures would be confined to interior

areas where erosion would not threaten them. Existing facilities within the recognized setback zone would be reconstructed to withstand erosion or relocated to the interior area.

This alternative does not prevent erosion nor improve safety for park users who may utilize the erosion setback area. Furthermore, the close proximity of the shoreline is a primary attraction to users of a shoreside park such as Paseo. Establishment of the erosion setback area would be very difficult due to the problems associated with estimating the future configuration or width of erosion area. It is likely that more liberal amounts of land would have to be set aside to allow for the uncertainty of estimating the limits of erosion-prone areas. Since the erosion would not be reduced, existing facilities and structures located within this setback zone may be damaged or lost unless reconstructed or relocated inland.

b. Structural Measures.

(1) Offshore Breakwater: An offshore breakwater is a structure designed to protect an area from wave action. This structure is usually constructed to intercept the movement of littoral material by dissipating the wave forces that would normally move it. In the same manner, an offshore breakwater can provide shoreline protection by dissipating wave energy that would normally strike the shore and cause erosion. Offshore breakwaters may be built as low profile structures, or to a height sufficient to prevent overtopping under design wave conditions, depending on the degree of protection desired. They can be continuous for long distances or segmented with passages between to allow exchange of water and are generally of rubble mound construction.

An offshore breakwater is not considered an acceptable solution to the problems and needs of the study area since the navigable areas of Agana Harbor would be drastically reduced. This measure would not eliminate shoreline erosion, however, the rate of erosion would be reduced. Based on the significant adverse impact this measure would have on navigation in Agana Harbor, this measure was not considered a viable alternative, nor evaluated in further detail.

(2) Bulkhead. A bulkhead is a structure which retains or prevents sliding of land and protects land against erosion damages. Precast concrete sheet pile, steel sheet pile, or timber pile can be installed in a vertical position along the shoreline and held in that position by tie-rods anchored to concrete blocks buried in the inland area.

A bulkhead would retain the greatest area of usable land for Paseo de Susana Park since its vertical geometric configuration would require very little space for installation. However, this alternative has certain significant disadvantages, which do not conform with planning objectives and evaluative criteria. Construction of the bulkhead includes extensive excavation to back-shore land areas for installation of the "deadman" anchoring system. This would require removal of all structures of the park within an approximate 50-foot distance from the shoreline. Excavation for installation of the anchoring system would greatly restrict the use of the park and shoreline. The impermeable vertical face of a bulkhead would not absorb or dissipate wave

energy, but instead, would reflect wave energy back to the harbor, possibly creating navigational hazards to ships in the entrance channel. In addition, a bulkhead along the harbor front would present potential safety hazards to park users and appears to be less visually acceptable than a stone structure. The cost of a bulkhead is very high compared to a gravity seawall or a stone revetment, primarily due to the extensive concrete "deadman" anchoring system which requires an extensive excavation operation. On the basis of the high cost of construction and the large-scale impact on park usage during construction, this alternative was not considered as a viable alternative for further detailed consideration.

(3) Seawall: A seawall is a structure separating land and water areas, primarily designed to prevent erosion and other damages caused by wave action. Seawalls are similar to the gravity retaining walls used on dry land. The stability of a seawall against wave and earth forces depends on its massive weight. The facing is generally vertical or a steep slope.

The vertical or near-vertical geometric configuration of a seawall allows maximum use of land areas within the park. Cement-rubble masonry (CRM) seawalls would be more aesthetically pleasing than a solid concrete structure. However, disadvantages associated with a seawall are the poor wave energy dissipation capability due to an impermeable vertical face, and potential safety hazard to park users, as with the bulkhead measure.

(4) Revetment: A revetment is a facing of stone, concrete blocks, sandbags, or other materials, built to protect a scarp, embankment, or shore structure against erosion caused by wave action. Revetments can be permeable or impermeable depending on the choice of materials.

Of the structural alternative measures considered, a revetment appears to best meet the planning objectives and technical criteria set forth in this section. A permeable sloping revetment has an excellent capacity for dampening wave energy. Although the sloping face of a revetment requires an amount of usable land area from the park for implementation, it would be visually compatible with the existing revetments in the study area. Cost of revetment construction is low compared to those of other shore structures, primarily as a result of ease of construction. Although there are many types of revetments and many kinds of materials available for construction, a stone revetment is the most practical and feasible type on the basis of cost, constructibility, availability of materials, durability, and maintenance.

### 3. ALTERNATIVE SHORE PROTECTION PLANS

Based on the identified problems and needs, the planning objectives, and the formulation and evaluation concepts, three alternative shore protection plans were developed for the Paseo de Susana Park.

All three proposed plans contain a common element consisting of 500 feet of revetment protection for the northeast tip of the park. The revetment will utilize 1.25 to 2.0 ton armor stones on a 1.5 horizontal to 1.0 vertical side slope and crest elevation of +10.0 feet MLLW. The revetment height will range from 0.5 feet to 3.0 feet above the existing ground at the park tip. To mitigate the effects of overtopping waves, the 200 to 500 pound underlayer stones are extended 10 feet inland of the revetment crest. The revetment toe



will be embedded 3.0 feet below the existing ground for scour protection. Where hard reef is encountered, the revetment will be placed directly upon the reef. All stone used in the proposed plans will be quarried limestone. The northernmost end of this revetment will be keyed into the existing stone revetment at the park tip and will stabilize the portion of the structure that is damaged. The alternative plans are shown on Figure 4 and are described as follows:

a. Plan 1. Plan 1 consists of the common 500 foot revetment protection for the northeast tip of the park, and 970 feet of revetment protection along the west or Agana Harbor side of the park. The west shoreline revetment will utilize 500 to 1000 pound armor stones placed on a 1.5 horizontal to 1.0 vertical side slope, with a crest elevation of +7.0 feet MLLW to match the average elevation of the park grounds. This revetment component will have a crest width of 12 feet, or 6 stones width, to mitigate the effects of overtopping waves during the most severe storms. The revetment toe will be embedded 3 feet below existing ground, as necessary, for scour protection. Details of Plan 1 are shown on Plates 1 and 2, with typical sections shown on Figures 5 and 6.

b. Plan 2. Plan 2 consists of the common 500 foot revetment protection for the northeast tip of the park, and 590 feet of revetment protection along the west or Agana Harbor side of the park. The west shoreline component of Plan 2 will possess the identical engineering characteristics of that proposed for Plan 1, and protects an incrementally shorter reach of the shoreline. This plan will avoid possible impacts to the circa World War Two Japanese bunker along the shoreline, as well as to the portion of the Paseo overlying the original Agana River delta. Present vegetation growth in the proposed unrevetted reach indicates a degree of shoreline stability associated with its location along the innermost protected berthing area of Agana Harbor. Further, the placement of 590 feet of revetment along the remainder of the harborside shoreline will act as additional wave absorber length, thereby further reducing wave heights reaching the landward 380 feet of shoreline. Details of Plan 2 are shown on Plates 1 and 3, with typical sections shown on Figures 5 and 6.

c. Plan 3. Plan 3 consists of the common 500 foot revetment for the northeast tip of the park, and 970 feet of combined revetment and nonstructural protection for the west, or Agana Harbor side of the park. The west shoreline component consists of revetment protection up to elevation +3.0 feet MLLW with 500 to 1000 pound armor stones on a 1.5 horizontal to 1.0 vertical side slope. The nonstructural component consists of fill above the revetment, from elevation +3.0 feet MLLW to +7.0 feet MLLW, on a 5.0 horizontal to 1.0 vertical side slope. The fill will be planted with Bermuda grass (*Cynodon dactylon*), temple grass (*Zoysia* sp), or seashore paspalum (*Paspalum vaginatum*) for stability. The nonstructural fill component will allow greater access to the waters of Agana Harbor for the fishermen due to the flatter side slopes in comparison to the revetment protection. Trampling of the vegetation will occur under the heaviest usage, and some damage to the vegetation and fill will occur during the most severe storm attack, however, adequate maintenance will mitigate these impacts. The nonstructural component will have a lower degree of permanence, requiring more frequent maintenance or nourishment by the local sponsor. Details of Plan 3 are shown on Plates 1 and 4, with typical sections shown on Figures 5 and 7.

#### 4. EVALUATION AND ASSESSMENT OF ALTERNATIVE PLANS

##### a. Estimated Benefits and Costs

(1) Benefits. Benefits accruing from each plan were derived from recreational benefits. Economic evaluations were conducted in accordance with procedures and standards prescribed by the Water Resources Council and Corps of Engineers' policy. Detailed analyses are presented in Appendix E.

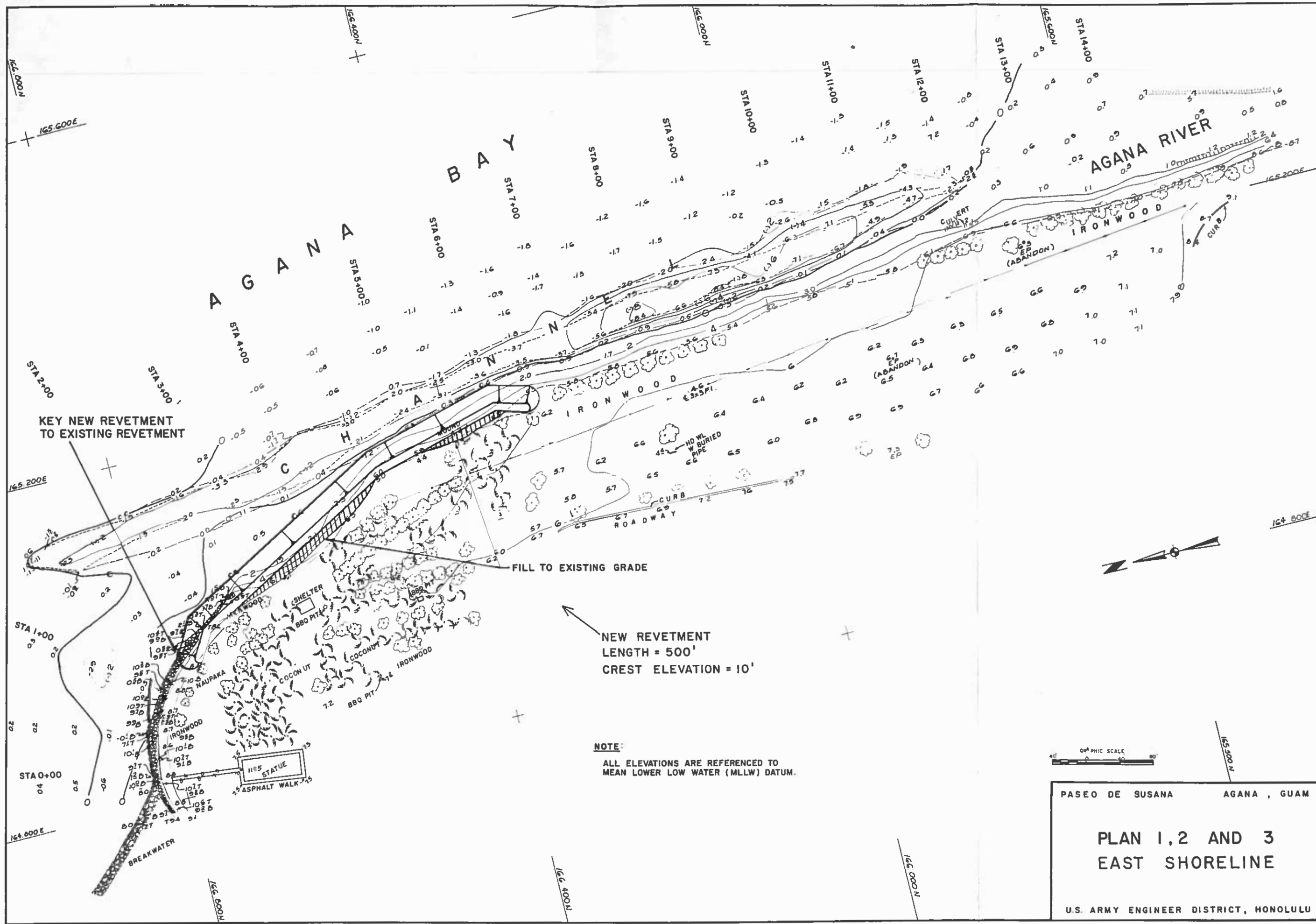
(2) Costs. Estimated project first costs were developed from November 1983 price levels and assumptions based on the prevailing physical conditions and construction methods suitable to the project area. The average annual cost for the purposes of the benefit to cost comparisons includes interest (8-1/8%) and amortization (50-years) of the project first cost and the estimated annual maintenance costs. Cost breakdowns and estimating assumptions are provided in Appendix D (Cost Estimate Section of the Engineering Investigations and Design Analysis Appendix).

(3) Benefit to Cost Comparison. Table 6 presents a summary of the estimated average annual benefits to average annual costs associated with each plan. This comparison represents the degree of tangible economic justification for each plan.

TABLE 6. COST-BENEFIT SUMMARY

|                                      | <u>Plan 1</u> | <u>Plan 2</u> | <u>Plan 3</u> |
|--------------------------------------|---------------|---------------|---------------|
| Total Estimated First Cost <u>1/</u> | \$1,500,000   | \$1,175,000   | \$ 886,000    |
| Estimated Interest During            |               |               |               |
| Construction                         | 122,000       | 79,000        | 56,000        |
| Total Investment Cost                | 1,622,000     | 1,254,000     | 942,000       |
| Interest @ 8-1/8% + Amortization,    |               |               |               |
| 50 years                             | 134,500       | 104,000       | 78,000        |
| Estimated Annual Maintenance         | 5,200         | 4,000         | 15,000        |
| Total Average Annual Cost            | 139,700       | 108,000       | 93,000        |
| Total Average Annual Benefits        | 283,000       | 206,000       | 283,000       |
| Net Benefits                         | 143,000       | 98,000        | 189,900       |
| Benefit to Cost Ratio                | 2.0           | 1.9           | 3.0           |

(4) Apportionment of Costs. The apportionment of costs between federal and non-federal interests corresponds to Section 103a of the River and Harbor Act of 1962, as amended, which prescribes the cost of sharing. This law limits federal participation to a monetary maximum of \$1 million. As the project site is a Territorial park meeting the necessary conditions of Section 103a, the Federal cost share is 70 percent of the total first cost, weighted by length for the west shoreline beach-type fill. The total project Federal share is therefore 63.2 percent of the total first cost.



165.600E

STA 2+00

165.200E

STA 1+00

STA 0+00

164.800E

STA 3+00

AGANA BAY

STA 5+00

STA 6+00

STA 7+00

STA 8+00

STA 9+00

STA 10+00

STA 11+00

STA 12+00

STA 13+00

STA 14+00

AGANA RIVER

164.800E

165.500N

FILL TO EXISTING GRADE

NEW REVELTMENT  
LENGTH = 500'  
CREST ELEVATION = 10'

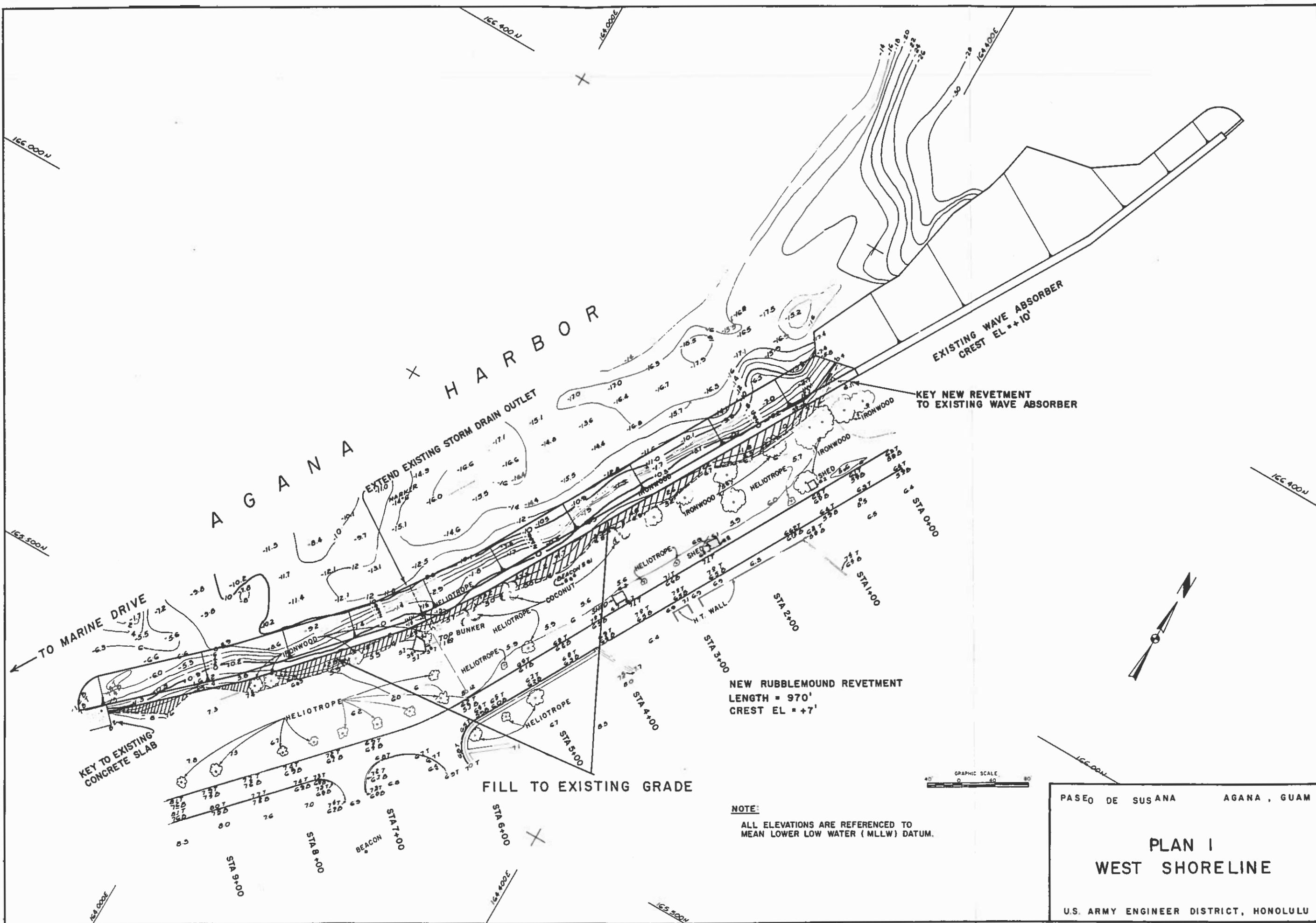
NOTE:  
ALL ELEVATIONS ARE REFERENCED TO  
MEAN LOWER LOW WATER (MLLW) DATUM.



PASEO DE SUSANA AGANA, GUAM

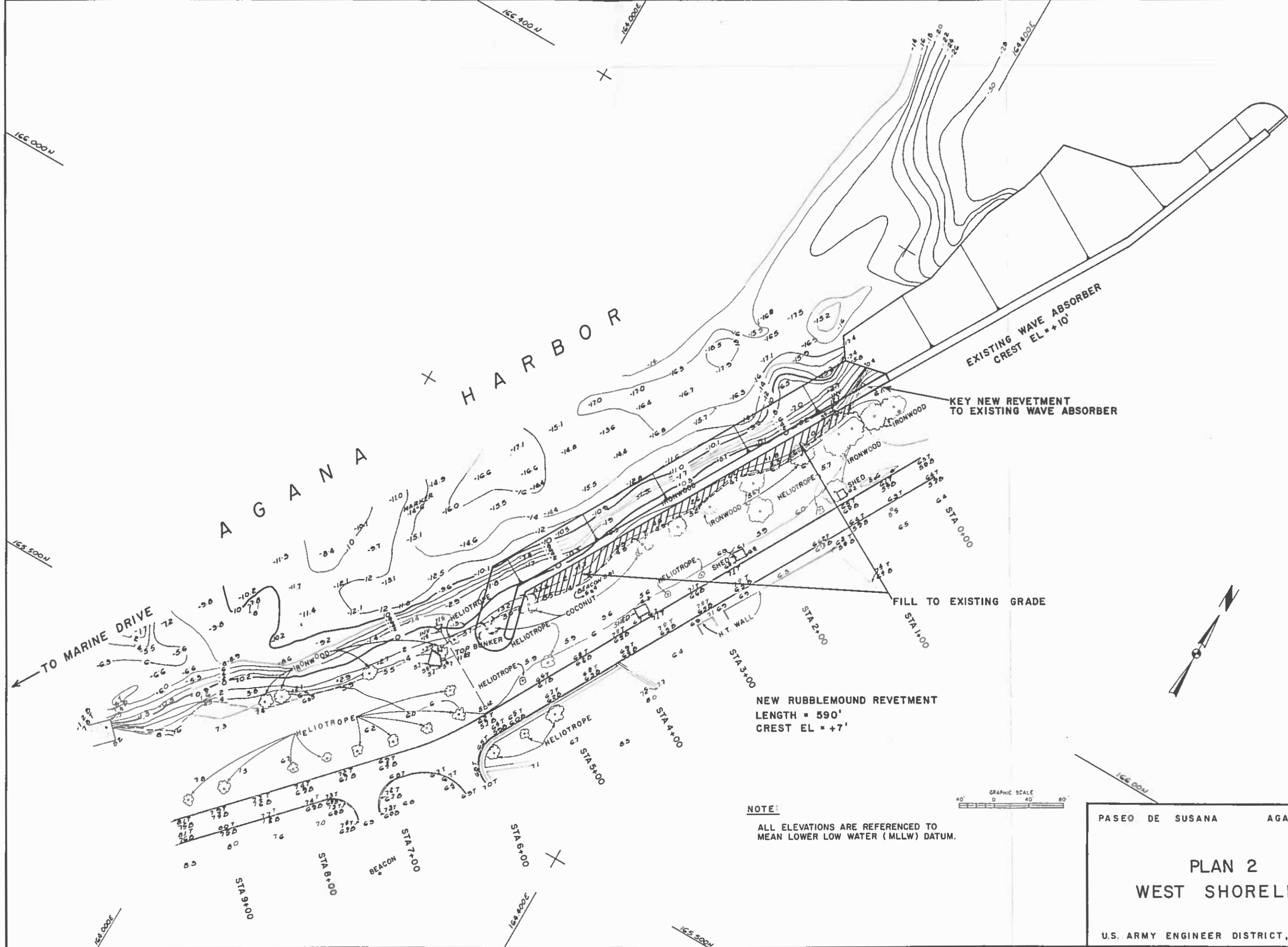
PLAN 1,2 AND 3  
EAST SHORELINE

U.S. ARMY ENGINEER DISTRICT, HONOLULU



**NOTE:**  
ALL ELEVATIONS ARE REFERENCED TO  
MEAN LOWER LOW WATER (MLLW) DATUM.

|                                        |  |             |
|----------------------------------------|--|-------------|
| PASEO DE SUSANA                        |  | AGANA, GUAM |
| <b>PLAN I</b><br><b>WEST SHORELINE</b> |  |             |
| U.S. ARMY ENGINEER DISTRICT, HONOLULU  |  |             |

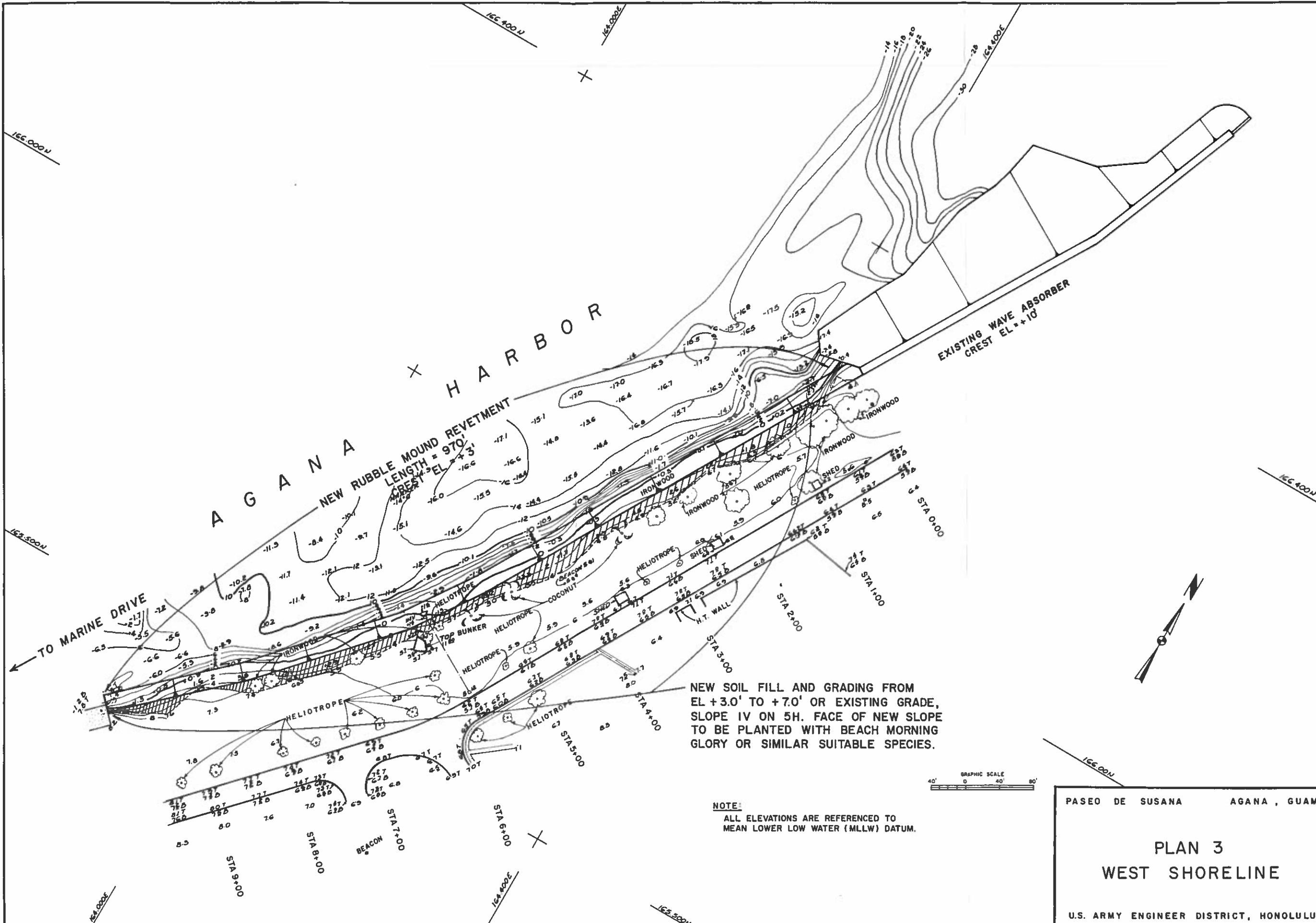


NOTE:  
ALL ELEVATIONS ARE REFERENCED TO  
MEAN LOWER LOW WATER (MLLW) DATUM.

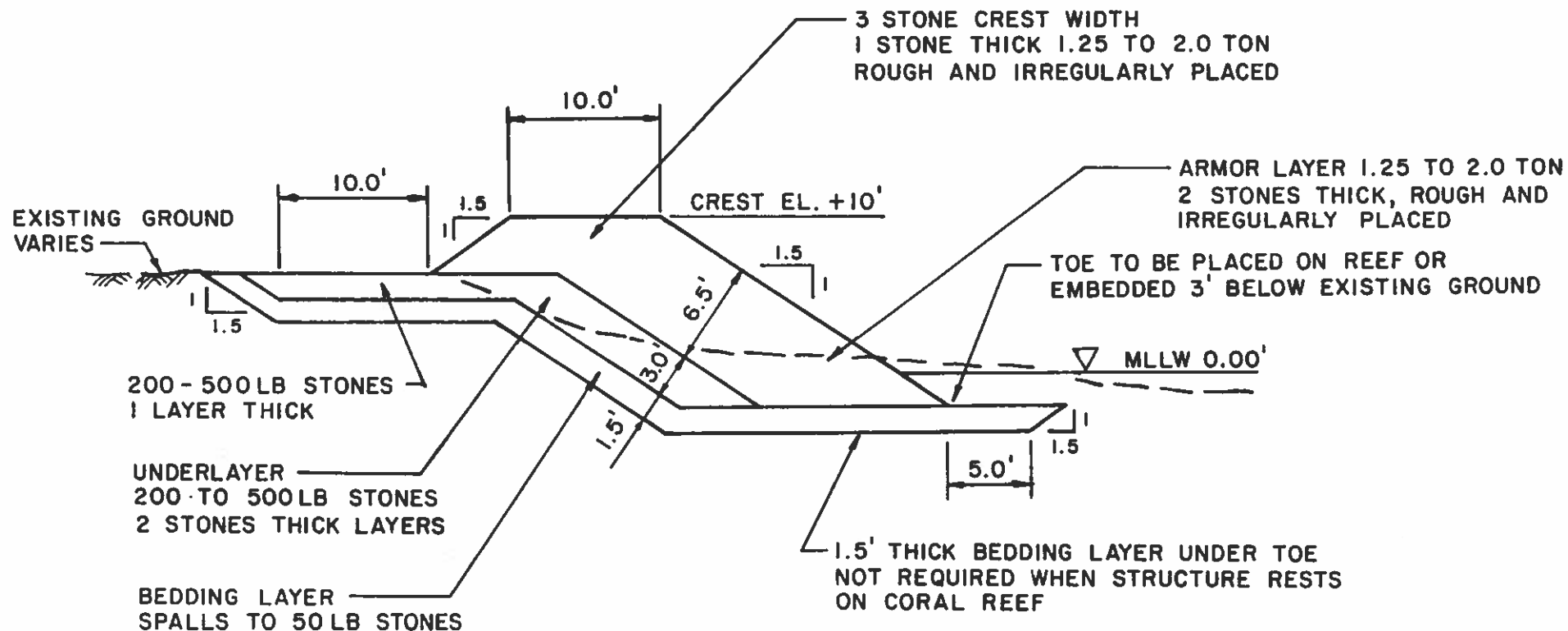
PASEO DE SUSANA AGANA, GUAM

PLAN 2  
WEST SHORELINE

U.S. ARMY ENGINEER DISTRICT, HONOLULU



PASEO DE SUSANA AGANA, GUAM



GRAPHIC SCALE

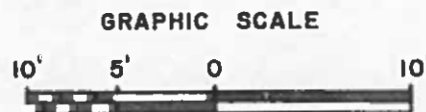
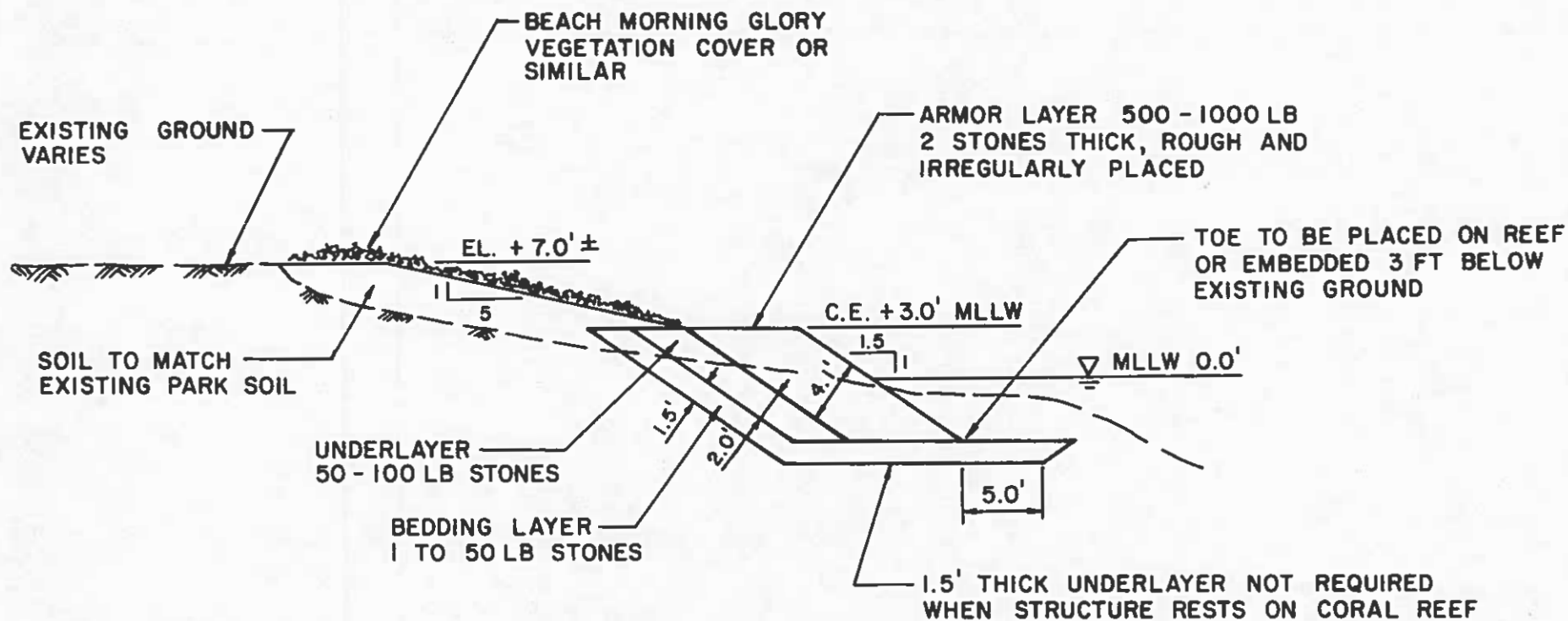


PASEO DE SUSANA SHORE PROTECTION  
AGANA, GUAM

**TYPICAL SECTION  
EAST SHORELINE  
PLANS 1, 2, AND 3**

U.S. ARMY ENGINEER DISTRICT, HONOLULU





PASEO DE SUSANA SHORE PROTECTION  
AGANA, GUAM

**TYPICAL SECTION  
WEST SHORELINE  
PLAN 3**

U.S. ARMY ENGINEER DISTRICT, HONOLULU

TABLE 7. APPORTIONMENT OF COSTS  
(\$1,000)

| Item                                          | PLANS               |                   |                   |
|-----------------------------------------------|---------------------|-------------------|-------------------|
|                                               | 1                   | 2                 | 3                 |
| Total Estimated First Cost <sup>1/</sup>      | \$1,500             | \$1,175           | \$ 886,000        |
| Pre-Authorization Study Cost                  | 120                 | 120               | 120               |
| Total Costs of Project                        | 1,620               | 1,295             | 1,006             |
| Statutory Federal Limit                       | 1,000 <sup>2/</sup> | 942 <sup>3/</sup> | 680 <sup>4/</sup> |
| Non-Federal Share of First Cost <sup>2/</sup> | 620                 | 353               | 326               |

1/ Excludes pre-authorization study cost.

2/ Section 103a statutory limit.

3/ Based on 70% of Estimated First Cost plus preauthorization costs.

4/ Based on 63.2% of Estimated First Cost plus preauthorization costs.

b. Summary Comparison of Alternative Plans. The evaluation of the economic, social, and environmental effects of each alternative plan is displayed in Table 8 (Summary Comparison of Alternative Plans and System of Accounts). This table displays the significant contributions, the beneficial and adverse effects, and the extent to which various planning objectives and evaluation criteria are met by each plan.

#### c. Compliance Requirements.

(1) Copies of the draft report were circulated to Federal and Government of Guam agencies as well as to interested groups and individuals. Copies were made available to the residents of Agana, Guam. The mailing list is provided in Appendix B.

(2) As part of the public involvement program, a public meeting was held on July 7, 1983, in Agana, Guam. Public notices were sent to the general public and media as well as to Federal and Government of Guam elected officials and governmental agencies. The meeting gave the public the opportunity to express their views concerning the proposed alternatives as well as on the effects of "discharge of fill material in the navigable waters of the US" and the "development of Federal activities within the base floodplain" under Section 404 of the Clean Water Act of 1977 and Executive Order 11988 (Flood Plain Management, dated 24 May 1977), respectively. Additional evaluation reports required by these acts are provided in Appendix A of this draft report. A transcript of the public meeting is provided in Appendix B.

(3) In accordance with the Fish and Wildlife Coordination Act of 1958, as amended, the US Fish and Wildlife Service provided a draft Section 2(b) report. Per their instructions, the draft report will also serve as the final report. A copy of this report is provided as Appendix C.

Revised 1 June 84

(4) In accordance with the Endangered Species Act of 1973, as amended, information on possibly-affected endangered species was requested from the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. The Corps' requests and agency responses are included in Appendix C.

(5) The Government of Guam Historic Preservation Officer, the Interagency Archaeological Service of the Heritage Conservation and Recreation Service, U.S. Department of the Interior and the U.S. Advisory Council on Historic Preservation were afforded the opportunity to review the adequacy of the study and findings under the National Historic Preservation Act of 1966 and the Archaeological Recovery Act of 1960 as amended. No responses were received from any of those agencies.

d. Summary of Comments Received. The Public Involvement Appendix B will include a summary of all the pertinent comments received regarding the Draft Detailed Project Report and Environmental Assessment. Letters received will also be reproduced in Appendix B under Pertinent Correspondence. Comments and responses pertaining to the Draft Environmental Assessment will also be summarized in the Final Environmental Assessment.

TABLE 8- SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEMS OF ACCOUNTS

|                                |                                                                                                             | NO IMPROVEMENT<br>"WITHOUT" CONDITION                                                                                                          | PLAN 1                                                                                    | PLAN 2                                                                                    | PLAN 3                                                                                     |
|--------------------------------|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| A. PLAN DESCRIPTION            |                                                                                                             | No shore Protection measures implemented. Shoreline continues to erode.                                                                        | 500' stone revetment along east shoreline with 970' stone revetment along west shoreline. | 500' stone revetment along east shoreline with 590' stone revetment along west shoreline. | 500' stone revetment along east shoreline. 970' along west shoreline graded and vegetated. |
| B. SIGNIFICANT IMPACTS         |                                                                                                             |                                                                                                                                                |                                                                                           |                                                                                           |                                                                                            |
| 1. <u>Economic</u>             |                                                                                                             |                                                                                                                                                |                                                                                           |                                                                                           |                                                                                            |
| Local Govt Finance*            | No Change.                                                                                                  | No Impact.                                                                                                                                     | No Impact.                                                                                | No Impact.                                                                                | No Impact.                                                                                 |
| Land Use                       | No Change.                                                                                                  | No Impact.                                                                                                                                     | No Impact.                                                                                | No Impact.                                                                                | No Impact.                                                                                 |
| Public Facilities and Services | No Change.                                                                                                  | No Impact.                                                                                                                                     | No Impact.                                                                                | No Impact.                                                                                | No Impact.                                                                                 |
| Regional Growth*               | No Change.                                                                                                  | No Impact.                                                                                                                                     | No Impact.                                                                                | No Impact.                                                                                | No Impact.                                                                                 |
| Employment*                    | No Change.                                                                                                  | No Impact.                                                                                                                                     | No Impact.                                                                                | No Impact.                                                                                | No Impact.                                                                                 |
| Business and Industrial*       | No Change.                                                                                                  | No Impact.                                                                                                                                     | No Impact.                                                                                | No Impact.                                                                                | No Impact.                                                                                 |
| 2. <u>Environmental</u>        |                                                                                                             |                                                                                                                                                |                                                                                           |                                                                                           |                                                                                            |
| a. General                     |                                                                                                             |                                                                                                                                                |                                                                                           |                                                                                           |                                                                                            |
| Marine Environment             | No impact to the shallow reef flat environment. Varying bottom substrate sand, coral, rubble and reef rock. | Increase in benthic and intertidal habitat.                                                                                                    | Same as Plan 1.                                                                           | Same as Plan 1.                                                                           |                                                                                            |
| Terrestrial Environment        | No Change.                                                                                                  | No Impact.                                                                                                                                     | No Impact.                                                                                | No Impact.                                                                                |                                                                                            |
| Fish & Wildlife                | No change to existing conditions.                                                                           | Loss of some sub and intertidal habitat. Temporary displacement of motile organisms during construction. Rapid recovery anticipated. (1, 6, 9) | Same as Plan 1.                                                                           | Same as Plan 1.                                                                           |                                                                                            |
| Water Quality*                 | No change. Presently good shoreline reef flat water quality.                                                | Temporary turbidity during construction. No significant long term effect<br>(1, 6, 9)                                                          | Same as Plan 1.                                                                           | Turbidity during construction and during establishment of vegetation.                     |                                                                                            |
| Circulation & Flushing         | No change from existing conditions.                                                                         | No Impact.                                                                                                                                     | No Impact.                                                                                | No Impact.                                                                                |                                                                                            |
| Air Quality*                   | No Change.                                                                                                  | No Impact.                                                                                                                                     | No Impact.                                                                                | No Impact.                                                                                |                                                                                            |

Table 8 Continued.

| NO IMPROVEMENT<br>"WITHOUT" CONDITION          |                                             | PLAN 1                                                                                                       | PLAN 2                                                               | PLAN 3                                                               |
|------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|
| <b>2. Environmental</b>                        |                                             |                                                                                                              |                                                                      |                                                                      |
| Natural Resources*                             | Natural, unaltered shoreline and reef flat. | Will commit 27,000 tons of quarried stone for protective structures.                                         | Will commit 20,700 tons of quarried stone for protective structures. | Will commit 16,400 tons of quarried stone for protective structures. |
| Man Made Resources*                            | No change from existing conditions.         | Preserve park land and facilities from erosion.                                                              | Same as Plan 1.                                                      | Same as Plan 1.                                                      |
| <b>3. Social</b>                               |                                             |                                                                                                              |                                                                      |                                                                      |
| Noise*                                         | No change from existing conditions.         | Temporary increase during construction, no long term change. (1, 5, 9)                                       | Same as Plan 1.                                                      | Same as Plan 1.                                                      |
| Population*                                    | No Impact.                                  | No Impact.                                                                                                   | No Impact.                                                           | No Impact.                                                           |
| Aesthetic Values*                              | No Change.                                  | Enhances appearance of shoreline and does not impair any viewing corridors.                                  | Same as Plan 1.                                                      | Same as Plan 1.                                                      |
| Historic Cultural and Archaeological Resources | No Change.                                  | No Impact.                                                                                                   | No Impact.                                                           | No Impact.                                                           |
| Recreation Opportunities                       | No Change.                                  | Restores and increases recreational area and opportunities.                                                  | Same as Plan 1.                                                      | Same as Plan 1.                                                      |
| Health, Safety and Community Well Being        | No Change.                                  | Enhances health, safety and community well being by eliminating erosion and restoring hazardous shore areas. | Same as Plan 1.                                                      | Same as Plan 1.                                                      |
| Community Growth and Cohesion*                 | No Change.                                  | Contributes to community cohesion through enhancement of recreation activities and opportunities.            | Same as Plan 1.                                                      | Same as Plan 1.                                                      |

**C. PLAN EVALUATION****1. Contributions to  
Planning Objectives**

Mitigate shoreline erosion

Yes

Yes

Yes

Enhance recreational and  
leisure opportunities

Yes

Yes

Yes

Preserve and enhance  
visual/aesthetic  
qualities

Yes

Yes

Yes

Table 8 Continued.

|                                                           | <u>NO IMPROVEMENT<br/>"WITHOUT" CONDITION</u> | <u>PLAN 1</u> | <u>PLAN 2</u> | <u>PLAN 3</u> |
|-----------------------------------------------------------|-----------------------------------------------|---------------|---------------|---------------|
| <b>C. PLAN EVALUATION</b>                                 |                                               |               |               |               |
| <b>2. <u>Response to Formulation</u></b>                  |                                               |               |               |               |
| <b><u>Criteria</u></b>                                    |                                               |               |               |               |
| <b><u>Technical</u></b>                                   |                                               |               |               |               |
| Protect shoreline from erosion                            | No                                            | Yes           | Yes           | Yes           |
| Compatible with park uses                                 | N/A                                           | Yes           | Yes           | Yes           |
| Compatible with harbor operation                          | N/A                                           | Yes           | Yes           | Yes           |
| 50-year project life                                      | N/A                                           | Yes           | Yes           | Yes           |
| <b><u>Economic</u></b>                                    |                                               |               |               |               |
| Benefits exceed costs                                     | N/A                                           | Yes           | Yes           | Yes           |
| Net benefits maximized                                    | N/A                                           | Yes           | Yes           | Yes           |
| <b><u>Environmental and Social</u></b>                    |                                               |               |               |               |
| Maintain visual qualities of shoreline                    | N/A                                           | Yes           | Yes           | Yes           |
| No adverse effects on social well being, health or safety | N/A                                           | Yes           | Yes           | Yes           |
| Enhance water quality and fish and wildlife resources     | N/A                                           | Yes           | Yes           | Yes           |
| <b>3. <u>Relationship to National Accounts</u></b>        |                                               |               |               |               |
| <b>National Economic Development (NED)</b>                |                                               |               |               |               |
| Average Annual Benefits                                   | N/A                                           | \$283,000     | \$206,000     | \$283,000     |
| Average Annual Costs                                      | N/A                                           | \$139,700     | \$108,000     | \$ 93,100     |
| Net Annual Benefits                                       | N/A                                           | \$143,300     | \$ 98,000     | \$189,900     |
| Benefit to Cost Ratio (B/C)                               | N/A                                           | 2.0           | 1.9           | 3.0           |
| Environmental Quality                                     | SEE ITEM B.2 ON THIS TABLE.                   |               |               |               |

Table 8 Continued.

|                                                             | NO IMPROVEMENT<br>"WITHOUT" CONDITION | PLAN 1                                                                                                     | PLAN 2                                                                                                           | PLAN 3                                                                                                           |
|-------------------------------------------------------------|---------------------------------------|------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| <b>C. PLAN EVALUATION</b>                                   |                                       |                                                                                                            |                                                                                                                  |                                                                                                                  |
| <b>3. <u>Relationship to National Accounts</u></b>          |                                       |                                                                                                            |                                                                                                                  |                                                                                                                  |
| <b>National Economic Development (NED)</b>                  |                                       |                                                                                                            |                                                                                                                  |                                                                                                                  |
| Other Social Effects                                        | SEE ITEM B.3 ON THIS TABLE.           |                                                                                                            |                                                                                                                  |                                                                                                                  |
| Regional Economic Development                               | SEE ITEM B.1 ON THIS TABLE.           |                                                                                                            |                                                                                                                  |                                                                                                                  |
| <b>4. <u>Response to Associated Evaluation Criteria</u></b> |                                       |                                                                                                            |                                                                                                                  |                                                                                                                  |
| <b>Acceptability</b>                                        | Not Acceptable.                       | High                                                                                                       | High                                                                                                             | High                                                                                                             |
| Completeness                                                | N/A                                   | Complete as described.                                                                                     | Same as Plan 1.                                                                                                  | Same as Plan 1.                                                                                                  |
| Effectiveness                                               | N/A                                   | Highly Effective.                                                                                          | Highly Effective.                                                                                                | Highly Effective.                                                                                                |
| Efficiency                                                  | N/A                                   | Highly Efficient.                                                                                          | Highly Efficient.                                                                                                | Highly Efficient.                                                                                                |
| Reversibility                                               | N/A                                   | Irreversible commitment of monetary rock and environmental resources.                                      | Same as Plan 1.                                                                                                  | Same as Plan 1.                                                                                                  |
| Stability                                                   | N/A                                   | High                                                                                                       | High                                                                                                             | Medium                                                                                                           |
| <b>D. IMPLEMENTATION RESPONSIBILITIES</b>                   |                                       |                                                                                                            |                                                                                                                  |                                                                                                                  |
| 1. Corps of Engineers                                       |                                       | Provide estimated project first cost share of \$880,000 design and construction of revetments.             | Provide estimate project first cost share of \$822,000 design and construction of revetments.                    | Provide estimated project first cost share of \$560,000 design and construction of revetment and earthwork.      |
| 2. Territory of Guam                                        |                                       | Provide estimated local first cost share of \$620,000. Provide assurances and cooperation and maintenance. | Provide estimated local first cost share of \$358,000. Provide local assurances and cooperation and maintenance. | Provide estimated local first cost share of \$326,000. Provide local assurances and cooperation and maintenance. |

**INDEX OF FOOTNOTES:****TIMING**

- Impact is expected to occur prior to or during implementation of the plan.
- Impact is expected within 5 years following plan implementation.
- Impact is expected in a longer time frame (15 or more years following implementation).

**UNCERTAINTY**

- The uncertainty associated with impact is 50% or more.
- The uncertainty is between 10% and 50%.
- The uncertainty is less than 10%.

**EXCLUSIVITY**

- Overlapping entry: Fully monetized in NED account.
- Overlapping entry: Not fully monetized in NED account.

**ACTUALITY**

- Impact will occur with implementation.
- Impact will occur only when specific additional actions are carried out during implementation.
- Impact will not occur because necessary additional actions are lacking.

(\*) Item specifically required in Section 122, Public Law 91-611 and ER 1105-2-240.

#### IV. THE RECOMMENDED PLAN

##### 1. RATIONALE FOR SELECTION

Plan 3 is considered the best overall plan for protecting the shoreline of Paseo de Susana Park. The project will meet the planning objectives of this study at less cost than the other alternatives considered while enhancing recreational usages of the park. Plan 3 is the National Economic Development (NED) Plan because it maximizes net benefits. The recommended Plan 3 will also:

- a. be compatible with existing and future uses of the park and the adjacent Agana Harbor;
- b. be economically justified with the largest benefit-cost ratio;
- c. not adversely affect any ecologically significant areas, habitats of economic/ecological values or the continued existence of any endangered or threatened species;
- d. will not affect any known cultural/archaeological resources;
- e. is supported by the local sponsor, the Government of Guam.

##### 2. PLAN DESCRIPTION

###### a. General Plan

The recommended plan of improvement shown on Figure 8 consists of a 500-foot long rubble mound revetment along the east seaward tip of the Paseo de Susana Park, with a 970-foot long reach of revetment combined with regrading and vegetation along the west (Agana Harbor) shore of the park.

###### b. Apportionment of Costs

Based on November 1983 price levels, the apportioned costs for the tentatively selected plan are shown below:

###### Apportionment of Costs for the Recommended Plan (November 1983 Price Levels)

|                                        |           |
|----------------------------------------|-----------|
| Total Estimated First Cost             | \$886,000 |
| Non-Federal First Cost Share           | \$326,000 |
| Corps of Engineers Share of First Cost | \$560,000 |

##### 3. PLAN IMPLEMENTATION

###### a. Construction Schedule

The work schedule for preparation of plans and specifications is approximately 6 months. Construction would be accomplished by contract and will require approximately 9 months to complete.

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#### b. Maintenance

The Government of Guam will maintain the project in its entirety. Maintenance of the revetment components of the recommended plan is estimated to require repair of 20% of the structure every 8 to 10 years at an average annual cost of \$3,000. Maintenance of the vegetative cover is estimated at a cost of \$12,000 annually, including replacement, trimming, fertilizing, and general maintenance. The total estimated annual maintenance cost to the Government of Guam is \$15,000.

#### c. Required Local Cooperation

Section 221 of the River and Harbor and Flood Control Act of 1970 (P.L. 91-611) requires that the local sponsor shall enter into a written agreement to furnish the required cooperation conditions prior to commencement of construction. Under the legislation and administrative policy of Section 103a of the River and Harbor Act of 1962, as amended, these conditions are:

(1) Provide without cost to the United States all necessary lands, easements, rights-of-way, or other real estate interests, as well as any relocations, disposal areas, or drainage improvements required for construction of the project;

(2) Hold and save the United States free from damages which may result from construction, operation and subsequent maintenance of the project, except damages due to the fault or negligence of the United States or its contractors;

(3) Assure continued conditions of public ownership and use of the shore upon which the amount of Federal participation is based during the economic life of the Project;

(4) Maintain and operate all works after completion in accordance with regulations to be prescribed by the Secretary of the Army.

(5) Provide and maintain necessary access roads, open and available to all on equal terms;

(6) Comply with the provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646);

(7) Comply with Title VI of the Civil Rights Act of 1964 (PL 88-352); and

(8) Subject to the Federal limitation of \$1,000,000, provide a cash contribution equivalent to 30 percent of the total construction costs of the project, with the final amount to be determined after all costs have been determined.

The Government of Guam has provided a letter assuring cooperation for the selected plan, which is included in Appendix B.

#### d. Compliance Documents and Certificates

All necessary Federal and local certifications for consistency and conformance to environmental (water quality, discharge, etc.) and land-use regulations must be completed prior to the initiation of construction.



FIGURE 8

## V. CONCLUSIONS AND RECOMMENDATIONS

### 1. Conclusions.

This Detailed Project Report provides an analysis of the problems and needs, environmental, economic, social and other considerations pertinent to the Paseo de Susana facility and analyses of alternative solutions, costs and benefits on the possible solutions to reduce erosion problems.

The District Engineer concludes that Plan 3, presented herein, will provide the necessary protection required for the Paseo de Susana Park. The proposed improvement can be constructed at an Estimated First Cost of \$886,000 with a benefit to cost ratio of 3.0.

### 2. Recommendations.

The District Engineer recommends that improvements to Paseo de Susana consisting of a 1470 foot long revetment and shoreline plantings be approved for construction. He further recommends that Federal funds be provided for construction, subject to the availability of the local required contribution and the execution of a Section 221 Agreement.

MICHAEL M. JENKS  
Colonel, Corps of Engineers  
District Engineer

**PASEO DE SUSANA SHORE PROTECTION  
TERRITORY OF GUAM**

**ENVIRONMENTAL ASSESSMENT**

FINAL  
ENVIRONMENTAL ASSESSMENT

PASEO DE SUSANA SHORE PROTECTION  
AGANA, TERRITORY OF GUAM

SUMMARY

a. Major Conclusions: The alternative plans and recommended plan are discussed in detail in Sections III and IV, respectively of the main report and in Section 2 of the Environmental Assessment (EA). All plans meet the planning objectives to mitigate shoreline erosion, enhance fishing and preserve aesthetic qualities at Paseo de Susana Park. The recommended alternative, Plan 3, best meets all three objectives. Plan 3 is also the National Economic Development (NED) plan and the Environmentally Preferred (EP) plan. As described in the draft report (June 1983), Plan 3 was not the EP plan. It would have interfered with shoreline fishing and would probably have generated long-term, intermittent water pollution of Agana marina waters due to erosion of soil. This plan has been redesigned to minimize erosion, will enhance access to the water's edge for hook-and-line fishermen, and will facilitate effective casting. An evaluation of the discharge of fill materials under Section 404 of the Clean Water Act of 1977 indicates the fill material and site are suitable and there will be no long-term adverse environmental effects. The project will not affect any endangered or threatened species nor affect any significant historic sites.

b. Areas of Controversy: None.

c. Unresolved Issues: None.

Further technical information about the assessment may be obtained from:

Dr. James E. Maragos  
U.S. Army Engineer District, Honolulu  
Fort Shafter, Hawaii 96858  
Telephone: (808) 438-2263/2264

ENVIRONMENTAL ASSESSMENT  
FOR  
PASEO DE SUSANA SHORE PROTECTION STUDY  
AGANA, TERRITORY OF GUAM

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## 1. PURPOSE AND NEED FOR THE PROJECT

a. Authority. The Paseo de Susana shore protection study is authorized by Section 103a of the River and Harbor Act of 1962.

### b. Need for Proposed Action.

(1) Shoreline erosion is a recurring problem due to the lack of shore protection and erosion control measures. Chronic erosion ranging from intermediate to severe is occurring along certain portions of the Paseo shoreline. In the last 36 years, about 40-50 feet of the peninsula has eroded. Because the site serves as a heavily used and very important recreational resource for the Agana area, protection of this valuable resource is necessary.

c. Previous Studies. The site of the proposed action overlaps that of the Agana Small Boat Harbor on the west side of the Paseo de Susana peninsula. The small boat harbor project, which has since been constructed, was assessed in a Final Environmental Statement prepared by the Pacific Ocean Division on 23 February 1973 and submitted to the U.S. Council on Environmental Quality on 11 May 1973. It was supplemented twice: first in August 1975 and then in March 1976. Many of the same descriptions of environmental conditions and construction impacts are similar to those of the present shore protection project. That FEIS and its supplements are incorporated by reference herein.

### d. Planning Objectives.

(1) Mitigate shoreline erosion at the Paseo de Susana Park at Agana, Guam.

(2) Enhance fishing, as well as other recreational and leisure opportunities for the people of Guam.

(3) Preserve and enhance the visual/aesthetic qualities of the park and shoreline.

## 2. ALTERNATIVES

### a. Proposed Plans.

(1) Three plans are proposed for assessment and evaluation. All three plans have a common component which is to provide a 500-foot-long rubblemound revetment on the northeast tip of the Paseo de Susana peninsula (Figure 4, Main Report). This revetment would have a crest elevation of +10 feet above mean lower low water (MLLW) and would rise from 1 to 4 feet above ground elevation. It will slope 1.5 to 1 with an armor layer of 1.25 to 2 ton stones. Stones for all revetments considered here would be quarried from an approved quarry site on Guam. Each revetment would also be backfilled to the existing escarpment with fertile soil and landscaped.

(2) Plan 1 would also provide a rubblemound revetment 970 feet along the western shore or side of the Paseo peninsula (Plates 1 and 2, Main Report). It would have a crest width of 12 feet and a crest elevation of +7 feet (MLLW), the approximate average ground level of the park.

(3) Plan 2 would provide for a shorter version of the Plan 1 revetment (Plates 1 and 3) with a length of 590 feet, but otherwise similar characteristics.

(4) Plan 3 would provide a rubble mound revetment 970 feet along the west shoreline with a 7-foot-wide bench of armor stone at a crest elevation of +3 feet (MLLW) and a front slope of 1.5 to 1. Soil fill on a 5.0 to 1 slope would be provided up to elevation +7 feet (MLLW). The soil fill will be stabilized with suitable ground cover such as Bermuda grass (Cynodon dactylon), Temple grass (Zoysia sp.) or Seashore paspalum (paspalum virginatum) (Plates 1 and 4). Plan 3 is the recommended plan the NED (dactylon) Plan and as now designed, the EP Plan.

#### b. Other Alternatives.

(1) Vertical seawalls were considered in early stages of the planning process, but were not given further attention because of the danger of wave reflection undercutting the toe of the structure, causing adverse wave conditions within the small boat harbor, and providing poor marine intertidal habitat.

(2) No Action would result in major, intermittent erosion to the existing slopes of the Paseo de Susana peninsula soon resulting in an undercutting of the pathway around the tip of the peninsula. In the western bank of the peninsula an undercutting of ten to fifteen park trees would soon occur together with the potential loss of concrete picnic tables and benches during a major storm event. Paseo de Susana is one of the most heavily used parks in Guam by local residents and tourists alike. Continued erosion will result in less recreational space and could result in potential safety hazards near the existing revetment on the tip of the peninsula.

### 3. AFFECTED ENVIRONMENT

#### a. Site Description.

(1) Guam is the largest island of the Mariana chain at approximately 30 miles long and 4 to 8.5 miles wide with a current (1980) population of 106,700 (Figure 1, Main Report). The 33-acre Paseo de Susana is a man-made peninsula and public park extending about 1500 feet northward from Agana Bay shoreline in central Guam (Figure 2, Main Report). The Agana shoreline and waterfront stretches approximately 3.5 miles, from Adelup Point at the west end eastward to Duncas Beach and Alupat Island. Agana has been Guam's governmental and commercial trade center since the Spanish occupation. The current mix of commercial and industrial enterprises, public facilities, and residences has nearly all been rebuilt since the city was completely destroyed during World War II.

(2) The Paseo de Susana peninsula (called hereafter as "the Paseo") is bordered on the west by the Agana Marina or small boat harbor and the Agana Sewage Treatment Plant and on the east by the present mouth of the Agana River. The entire peninsula is dedicated to public park use including a wooded picnic area covering the outer tip, a new concrete stadium in the middle, and bordering along Marine Drive (west to east) is a new temporary building housing the fishermen's cooperative; a sewage pump station; a defunct, traditional Chamorro village tourist complex; lunch stands offering Chamorro take-out food; the Agana District Commissioner's office; and the Paseo (traffic) loop and Chief Quipuha Park adjacent to Agana River mouth.

(3) Paseo de Susana was transferred from Federal to Government of Guam ownership in July 1960 through Congressional enactment of PL 86-664 which states that the property shall be used solely for civic, park and recreational uses or will revert back to Federal ownership.

(4) The Paseo peninsula's shoreline consists mostly of scattered and crumbling riprap, dead coral boulders and rubble, and coarse sand along the east and west sides. Banks are undercut in several locations. The seaward tip of the peninsula consists of concrete and riprap. A stub breakwater extends from the northwestern tip of the peninsula and protects the entrance to Agana boat channel. The eastern shore is spotted with rusting debris from old machinery and buildings.

#### b. Historical Background.

(1) General. Agana has been the administrative and commercial center of Guam for over 300 years and most certainly was a significant habitation area in the prehistoric era which could date to as early as the second millenium B.C. Nearly all of the peninsula known today as Paseo de Susana was created by fill material composed of rubble from World War II destruction of Agana in July 1944 by Allied bombing of Japanese positions. The eastern third of the peninsula, except for the tip, was filled in the late 1950's or early 1960's. Based on the type of machinery parts observed by Corps personnel in the western eroded bank and knowledge of pre-war Agana, much of the bulk forming the Paseo probably came from the Agana Power Plant, which was located near the present-day corner of Soledad Avenue and Castillo Lane and from the old Agana Navy Yard, which was located immediately seaward of the power plant. Portions of the southwest quadrant of the Paseo are underlain by the old Agana River delta and could contain valuable prehistoric cultural sediments and material. The debris and other material making up the northeast part of the peninsula was placed in the latter 1950's or early 1960's, according to an analysis of maps and aerial photographs. Visual inspection of that area in March 1983 indicated the presence of mostly vehicular parts of no significance.

(2) Japanese Pillbox. The site of a Japanese pillbox (adjacent to Station 6+00), dating from the World War II era, probably marks the seaward extent of prewar Agana Navy Yard. The pillbox is similar to other pillbox features along the coast of Guam, but the only one still extant on the shoreline of Agana Bay. The pillbox is listed on the Guam Register of Historic Places but is not considered significant enough by itself for inclusion on the National Register of Historic Places. Advice was sought from the Guam Historic Preservation Officer regarding the significance of the pillbox feature. No response has been received.

#### c. Marine Environment.

(1) Sources. Description of the marine biological resources of the study area is based primarily upon U.S. Fish and Wildlife Service products, including a Planning Aid Letter prepared in September 1982, a Coordination Act Report prepared in April 1983, and a letter prepared in May 1983 transmitting and endorsing additional information from the Guam Department of Agriculture, Aquatic and Wildlife Resources Division. This is supplemented by Corps staff observations and field coordination with the Guam Department of Parks and Recreation and Division of Aquatic Resources, Department of Agriculture in March 1983.

(2) General. Agana Bay is fringed by shallow reef flat ranging from 1200 to 2700 feet in width (west to east). At mean lower low water (MLLW) the outer reef flat is covered by only inches of water which ranges shoreward to about 3 feet depth in the moat or inner reef flat. At the Paseo, the reef flat is 2000 feet wide. The outer tip of the peninsula lies on the outer reef flat, but the western side of the peninsula slopes steeply down to -9 to -16 feet (MLLW) in the boat channel and turning basin. The bank on the eastern

side slopes more gradually across a 10- to 20-foot-wide shallow area then steeply down into a man-made channel ranging from about -4 to -8 feet (MLLW).

(3) Benthos. According to the U.S. Fish and Wildlife Service, benthic habitat along the edges of the two channels consists principally of dead coral rubble and concrete blocks overlain by substantial amounts of silt. Observed on the shoreline were bits of Sargassum sp algae and occasional invertebrates such as sea cucumber (Holothuria), small limpets and strombs, Trochus sp. shells, and hermit and grapsid crabs. Off the northeast tip of the peninsula on the outer reef flat are widely-scattered patches of the coral Porites lutea. On the reef margin is an algal mat of mostly Amphiroa, Sargassum and Caulerpa and again, widely scattered P. lutea corals. The small boat harbor channel slope is composed of rubble, gravel and sand interspersed with rocky outcroppings and coral knobs. The corals Millepora dichotoma, Pocillopora damicornis, and P. lutea were observed there. The conclusions to be drawn from this description is that the marine margins of Paseo de Susana are not highly productive areas.

(4) Fishing. The Agana boat channel is probably the single most important hook-and-line sports fishery in Guam, particularly when seasonal catches of atulai (mackerel and other caranginids) and manahac (rabbit-fish and blennies) are abundant. The atulai season runs for four to five months between August and November and then manahac season runs from about March to June in the last quarter of the moon. Periodically during these seasons, the waters of the channel may be teeming with fish and the banks are teeming with people both day and night. The manahac are also caught by net fishermen operating on the front reef flat. Manahac predators such as skipjack, tuna and barracuda are caught in large numbers during good manahac runs by fishermen concentrating their efforts at the mouth of the boat channel. When the manahac and atulai run, people day camp in Paseo and on Bayfront Beach, near the Marina. This sports and subsistence fishing activity, focused on the west bank of Paseo, is the most important environmental resource opportunity in the study area. In addition, hook and line fishing for ee (ii) or juvenile skipjacks on both sides of the Paseo is also very popular. The Aquatic & Wildlife Resources Division of the Guam Department of Agriculture have also emphasized that many reef fishes including several acanthurids, carangids, labrids, lethrinids, lutjanids, mugilids and mullids are commonly caught on the East Agana Bay reef flat and moat by net, spear, and hook-and-line fishermen. A major point of departure to this latter reef-flat fishery is off the tip of Paseo. The Aquatic and Wildlife Resources Division of the Guam Department of Agriculture, using inshore reel censuses conducted year-around, roughly estimates that over 16,000 fishermen per year may be fishing here.

(5) Water Quality. Territory of Guam Water Quality Standards, as most recently adopted on November 16, 1981, designate the waters around the Paseo de Susana (and all of Agana Bay) as M-2. Marine Water Category M-2 is good, calling for uses to protect the propagation and survival of a balanced and indigenous population of marine organisms, particularly shellfish and coral reefs. Other important and intended uses include mariculture activities, aesthetic enjoyment and compatible recreation inclusive of whole body contact and related activities. According to unpublished GEPA water quality measurements taken off Padre Paloma Park (immediately east of the Paseo peninsula), 9 of 15 (17.6%) measurements in 1980 and 8 of 57 (11%) in 1981 exceeded Guam water quality standards for fecal coliform count. At a station located within Agana Marina, results were similar with 14 percent of measurements exceeding the standards in 1981 and 17 percent exceeding in 1982. Each incidence of the standards being exceeded resulted in the waters nearby being closed to swimming for a week. Most incidents of poor water

quality in Agana Bay are caused by storm-water runoff through point-source discharges. There is one point-source discharge into the Agana Marina; the Agana River is another source of runoff.

d. Terrestrial Wildlife. The U.S. Fish and Wildlife Service reports that vegetation along the shore above the beach consists of scattered ironwood (*Casuarina equisetifolia*), "nanaso" (*Scaevola taccada*), "alahai tasi" (*Ipomoea pes-caprae*), "hunek" (*Messerschmidia agrentea*), coconut palm (*Cocos nucifera*), "binalo" (*Thespesia populnea*), beggar's stick (*Bidens pilosa*), *Wedelia* sp., *Lippia nodiflora*, and several species of grasses. Observations by Corps personnel also reveal an active population of field mice living among the roots of shoreline trees along the eroding bank near the Marina which feed off picnic leavings.

e. Endangered or Threatened Species. Avian biologists from the Aquatic and Wildlife Resources Division report observing the locally-endangered Micronesian Starling (*Aplonis opacus*) in coconut trees adjacent to the small boat harbor. Nevertheless, neither the U.S. Fish and Wildlife Service nor the U.S. National Marine Fisheries Service reported any Federal threatened or endangered species, listed or proposed, present in the proposed project area. The National Marine Fisheries Service did note that green turtles (*Chelonia mydas*), which are Federally listed as threatened, may be occasionally sighted in the vicinity, but they had no confirmed reports of such activity at Paseo.

f. Recreation and Other Park Activities.

(1) Paseo de Susana Park. The 33-acre park is under the jurisdiction and responsibility of the Guam Department of Parks and Recreation. The Paseo is used increasingly as a center for organized sports, fishing, picnics and as a tourist destination. Guam's warm climate permits year-around use of the new stadium for baseball, football and other sports. Fishing, mentioned above, is conducted mostly along the boat channel but also some occurs on the eastern side of the peninsula. Noon picnickers from the nearby downtown Agana administrative offices often enjoy their lunches under the shady trees along the western bank and at the tip of the peninsula. About ten small fast-food stands offer local fare to Guamanians and tourists alike. The marine exposure, the statues of the ancient Chamorro Chief Quipuha and a miniature "Statue of Liberty" attract thousands of tourists each year. Nearly all the 225,000 Japanese tourists now (1980) visiting Guam stop by the Paseo on the regular tours around the island, according to sources at the Guam Visitors Bureau.

(2) For the past five years, a Government of Guam sponsored public market operated along Marine Drive, just within the park. The market structure burned down in mid 1982 and has not been rebuilt. The Department of Commerce which managed the market has recently relinquished its support of the activity, but food stands continue to operate there. There is also an open-air, traditional shelter named the Sagan Dinana ("Place of Togetherness") which was constructed by the local government to serve as a centralized civic meeting place for community activities, but it is not frequently used because of nearby traffic noise from Marine Drive.

(3) The Agana Bay Urban Waterfront Redevelopment Plan, issued in 1981, identified a number of problems resulting from the increased demand for Paseo de Susana Park. These include (a) insufficient picnic shelters and tables,

(b) insufficient landscaping, (c) disrepair of roads, (d) shoreline erosion, and (e) seawall deterioration. There are three concrete picnic tables immediately adjacent to the eroding west bank of Paseo facing the boat channel. The lack of landscaping mainly refers to a large open area east of the stadium and along the eastern bank. Another problem, revealed by conversations with local residents picnicking near the seaward tip of the peninsula, is a lack of outdoor lighting which may contribute to robberies during evening hours.

(4) Surfing. Surfing on both sides of the new entrance channel to Agana Marina is a popular activity. According to surveys conducted in 1971 among the Agana surfers as reported in the Corps' 1973 Final ES for the Agana Small Boat Harbor, both sides of the mouth of the old entrance channel are good to excellent for surfing about 50 percent of the year with an average of six-foot waves. In March 1983, ten surfers were observed using the boat channel site during the early evening of a Wednesday and also on a Saturday. Access to and from the entrance channel is mainly from the end of the stub breakwater off the tip of Paseo and also from the existing wave absorber and the small beach in the lee (south) of the stub breakwater. According to local windsurfers, access to the entrance channel and seas outside for them is mainly from west shore of Paseo, both off the existing wave absorber and the currently eroded bank. No windsurfers were observed in March 1983.

(5) Agana Marina. The present small boat harbor, completed by the Army Corps of Engineers in 1977, has not yet been fully developed by the Government of Guam Department of Parks and Recreation, under whose control it operates. The Agana Marina Master Plan's ultimate development stage would site a fuel dock and chandlery on Paseo at approximately Station 8+00. At present, however, the Guam Fishermen's Cooperative has erected a one-story, 1600-square foot Butler-type building in the same area (Stations 6+50 to 8+00) to house in its offices a market and freezing equipment.

g. Section 122 Resources. Section 122 of the River and Harbor Act of 1970 supplements the provisions of the National Environmental Policy Act of 1969 by requiring that all Corps projects take into consideration at least 17 special, possible adverse economic, social and environmental effects relating to any proposed project, the cost of elimination or minimizing such adverse effects, and the need for flood control, navigation and associated actions. The minimum list of 17 "effects" are desirable regional growth, employment/labor force, local governmental finance, business and industrial activity, displacement of people or farms, desirable community growth, population, public services, public facilities, aesthetic effects, community cohesion, noise, air pollution, water pollution, natural resources, and man-made resources. Public facilities, aesthetic effects, water quality, natural and man-made resources are treated in the above paragraphs. Ambient levels of noise and air pollution are relatively high due to the proximity of Paseo de Susana to the road intersections along Marine Drive highway having the highest volume of vehicular traffic in Guam. These levels have not been empirically measured, but must certainly decline as one moves seaward. The remaining effect categories are discussed under the Environmental Effects section of the EA.

h. Coastal Zone Management Areas of Particular Concern. The Guam Coastal Management Program designates areas of particular concern (APC's) to consider in planning any activity in Guam. Of the nine categories of APC's, three are applicable to Paseo de Susana: flood hazard areas, the Agana Bay Urban

Waterfront, and shoreline development areas including boating and fishing, park areas and surfing areas. The questions of flood hazards will be discussed in part in Appendix A of this report. Flooding from storm surge, which often accompanies storm waves, is believed to be able to reach an elevation of about 12 feet above sea level during a 100-year storm event. Under the present conditions at Paseo, such a flood event could inflict heavy damage on the existing park facilities.

#### 4. ENVIRONMENTAL CONSEQUENCES

a. Historic Sites. No sites or other cultural material of prehistoric or historical significance will be affected by implementation of any of the three alternative plans. The revetment under Alternative Plan 1 and the vegetative planting under Plan 3 will skirt the Japanese pillbox, but there will be no adverse effects on the structure and perhaps a long-term beneficial effect by preventing it being undercut by erosion. The rusting pre-war machinery eroding out of the eastern and western shorelines is out of context and not significant. The machinery will be preserved by backfill and rocks placed as part of the shore protection measures.

b. Biological and Water Quality Effects.

(1) Benthos. The U.S. Fish and Wildlife Service Coordination Act Report indicated that no significant long-term impacts to the marine or terrestrial environments were anticipated as a result of shore protection improvements at Paseo de Susana. Adverse effects to fishes and adjacent benthic habitats will probably be limited to the construction phase of project implementation. No blasting will be needed for construction. During construction, grading and cutting the existing shore and placement of fill material may introduce suspended fine sediments into nearshore waters. If these plumes are not contained to the immediate project area, they may stress corals in adjacent waters outside the channel. Placement of stone riprap along the shoreline will bury some sub- and intertidal habitat. However, the resulting surfaces will be suitable for colonization by algae and invertebrates. Any alterations in normal water circulation patterns around the peninsula by the proposed project are expected to be slight, and not of sufficient magnitude to significantly affect the distribution and abundance of marine life in surrounding waters.

(2) Fishing. Construction will temporarily limit access to the shoreline for recreational fishing. Because of the significant value the west bank of Paseo has for sport and subsistence fishing, construction should be scheduled, if possible between late November and early March, the period of the year when the atulai and manahac are not running. The numbers of fishermen that periodically crowd the west bank of the Paseo should not be significantly affected by the existence of a revetment as proposed by Alternative Plans 1 and 2. The stone bench under Plan 3 may permit fishermen to stand nearly shoulder-to-shoulder, but the revetment would allow them to stagger themselves, one standing higher on the rock face and the other standing lower so that just as many could be accommodated. Moreover, during time of slack fishing, the crevices in the revetment face would permit the fishermen to easily stick one's pole or poles into a crevice, allowing the fishermen to sit back and relax. The flat upper (5.0:1) slope under Plan 3 should not be a major obstacle to effective casting into the boat-channel waters. During periods of

high use, the crowds of fishermen may create dirt paths in the grass, thus lessening its effectiveness.

(3) Water Pollution. Placement of rocks (all plans) into the waters off Paseo de Susana peninsula will cause temporary and intermittent rises in levels of ambient turbidity and other suspended materials. Plan 3 has been redesigned to minimize long-term degradation of adjacent water quality. Vegetating the upper soil embankment of the revetment with shortly-cropped Bermuda grass (*Cynodon dactylon*) or similar species and flattening the slope from 3.5 to 1 to 5.0 to 1 should significantly reduce susceptibility of the embankment to erosion. The 7-foot-wide stone bench at the base of the embankment will intercept much of any soil that does erode down, significantly reducing the amount of suspended material entering the nearshore waters in the long term. Water pollution effects are also discussed in the Section 404 Evaluation in Appendix A.

(4) Terrestrial Wildlife. Only one park tree, a coconut at Station 5+25 under Plan 2, would require removal under any of the alternative plans. The affected tree would be transplanted. Fill material used in Plans 1 and 3 would be placed around six trees and two trees under Plan 2, thus saving them from imminent loss due to on-going erosion. The mice habitats among the roots of these trees may be smothered during fill operations, but given the amount of picnic leavings continually available, new mice populations will probably be attracted to the picnic area.

(5) Endangered or Threatened Species. No territorial or Federally-listed endangered or threatened species of plants or animals will be affected by implementation of any of the alternatives.

#### c. Effects on Recreation and Scenic Resources.

(1) Park Activities. None of the recreational and other activities now occurring in Paseo de Susana Park will be significantly affected by implementation of any of the alternatives. Plan 3 should allow easy access to the shoreline for fishing. No matter when construction of any of the plans does take place, it will interfere with year-around recreational fishing and will preclude safe picnicking near the areas under construction. The noise of trucks and a crane will also disturb park users. During construction, the numbers of park users may temporarily decline, but when the revetment or vegetated bank is completed, park usage should return to previous levels, or perhaps increase.

(2) Park Facilities and Aesthetics. Of the five overall recreational/aesthetic problems noted by the Agana Bay Urban Redevelopment Waterfront Plan (see Paragraph 3f(3) above), the shore protection project only directly addresses two of them: shoreline erosion and seawall deterioration. New landscaping will be limited to replacing in kind or transplanting affected plants. There are three sets of concrete picnic tables and benches on the west bank which may be affected by construction activities. These park facilities, however, are relocatable and thus must be the responsibility of the local sponsor to relocate or replace. On the other hand, the low height of the revetment on the west bank--averaging one foot or less above the park ground level--will provide new surface to sit on or lie again. The visual intrusion of the stone revetment may be greater than the vegetated one, but regular park users are accustomed to the existing stone structure and should readily adapt to an extension.

(3) Surfing and Swimming. There should be no effect of any of the alternatives on board or wind surfing activities. Observations made of surfers returning to shore showed no particular preference for a landing site choosing between the existing stone revetment or the natural bank. Concerns were raised at the Public Meeting held July 7, 1983 about the danger of drowning in the deep channel water off the western shore. The proposed stone bench feature of Plan 3 will increase this danger unless appropriate safety measures are implemented such as a low iron pipe fence.

(4) Relationship to Agana Marina. None of the alternative plans adversely affect the current operations of the small boat harbor or would be incompatible with the ultimate development of the marina. There is a sloping, unpaved lane to the water's edge at Station 4+00 which has served informally from time to time as a boat ramp. The loss of the ramp is not viewed as an adverse effect to the operations of the harbor because there is already a concrete ramp available within the present boat basin. There are, at present, no known plans to construct a pier alongside the new Guam Fishermen's Cooperative building, but should one be needed, permanent stability would be given to the existing bank only by the stone revetment proposed as Plan One.

d. Section 122 Effects. The following effects have been fully considered with respect to possible adverse economic, social and environmental effects resulting from implementing any of the alternative plans.

(1) Desirable Regional Growth. None of the proposed alternative plans would have any effect on changing the patterns of residential or economic growth in Guam. Protecting the facilities of one of the most heavily used parks in Guam may, in the long-term, encourage more people to enjoy Paseo de Susana Park.

(2) Employment/Labor Force. Implementation of any of the alternative plans would provide short-term employment for a small insignificant number of laborers and supervisors. No long-term or even short-term significant changes will occur in overall Guam employment and labor force levels.

(3) Public Facilities and Services. These effects are fully described in the paragraphs above. No unusual services such as water, electricity, garbage disposal or protective/health services should be affected by this project.

(4) Business and Industrial Activity. There should be no significant effect on business and industrial activity except for the construction firm which would build one of the alternatives. During construction, the unavailability of some picnic areas could adversely affect the levels of business done by the small local foodstands located adjacent to Marine Drive. After construction is complete, this business should return and could reach higher levels than present due to higher numbers of picnickers possibly using the revetment for a resting place.

(5) Displacement of People or Farms. No people or farms will be displaced or otherwise affected by implementation of any of the three alternatives.

(6) Desirable Community Growth. This project will have no effect on patterns of local community growth.

(7) Aesthetic Effects. All alternatives will be visual intrusions into the sparsely forested landscape of Paseo de Susana, particularly the stone revetments. Regular park users should be able to easily accommodate themselves to the new man-made scenes.

(8) Community Cohesion. Fishermen are the only sub-community likely to be concerned about the effects of building a rubblemound or vegetated soil and rubblemound revetment along their favorite stretch of fishing grounds. If construction on the west bank of Paseo can be accomplished mostly during the off-season for fishing (late November to early March), discontentment among fishermen and the general public will probably be held to a minimum. Construction of the stone revetments is believed to create the least probable discontent, but the redesigned recommended Plan 3 may be viewed more favorably than during the draft report stage.

(9) Air and Noise Pollution. Adverse impact to ambient air and noise conditions in the project area would be temporary and intermittent during construction. These impacts would be significantly lower if the vegetation and grading component was constructed. Noise from the construction equipment should not significantly affect the locally threatened Micronesian starling due to the already relatively high ambient noise from Marine Drive traffic. All equipment will comply with applicable Federal and local regulations governing air and noise pollution.

(10) Water Pollution. Water pollution effects of the alternatives on water pollution is discussed above in Paragraph 4b(3) and in the Section 404 analysis in Appendix A.

(11) Natural Resources. Effects of the alternatives on natural resources are discussed above in Paragraph 4b.

(12) Man-Made Resources. Effects of the alternatives on man-made resources are discussed above in Paragraphs 4a and 4c.

e. Areas of Particular Concern.

(1) General. Flood hazard areas and the Agana Bay urban waterfront are the only two officially promulgated areas of particular concern (APC's) affected by the proposed project. Considered unofficially under the Guam Coastal Management Program for the study area is the category of shoreline development (Paragraph 4c) which includes concerns for boating, fishing, parks and surfing areas.

(2) Flood Hazards. Construction of Plan 1 would have the most beneficial effect on reducing possible damage to park facilities from high storm waves and storm surge. Plans 2 and 3 would probably have lesser beneficial effects, respectively. During a major typhoon, however, wind damage and flooding from Agana River could offset much of the protection offered by the revetments to park resources such as trees and other plantings and various structures. The relationship of the alternatives to local flood hazard regulations is treated in detail in Appendix A.

(3) Agana Bay Urban Waterfront. Implementation of any of the alternative plans would be compatible with the objectives and some of the recommendations of the 1981 plan.

f. U.S. Fish and Wildlife Service Recommendations.

(1) The Service suggests that the Corps adopt certain measures to mitigate construction-related impacts and enhance recreational use of the park during project planning. Included are measures recommended by the Guam Aquatic and Wildlife Resources Division.

(a) Efforts should be taken to confine suspended sediments to the immediate project area during construction. Dredged, cut or graded material should be protected from erosion, and only clean water should be allowed to runoff into the harbor and bay.

(b) If practicable, construction of the western (harbor) side improvements should begin at the close of the annual atulai season (December), and should be completed as soon as possible. Safe shoreline access should be provided for fishermen at Paseo de Susana to the maximum extent possible during construction.

(c) The project area should be revegetated with indigenous strand and shade plants and trees to enhance the educational and aesthetic value of the park.

(d) Fishing opportunities at the Paseo should be considered in the design of the proposed action, such as incorporation of a solid concrete ramp(s) leading to a solid concrete cap(s) atop or on the ocean side of the revetment so that the very young, elderly, and physically handicapped may continue to safely fish these nearshore waters.

(e) A ramp/walkway atop or along the ocean side of the revetment would provide access to fishermen as well as provide strollers and tourists with better views of the ocean, boat harbor, and coastline, which will be impaired at ground level by an 8 to 10-foot high structure.

(f) A ramp or stairway leading down to the water's edge would allow easier access to the reef flat on the eastern side of the Paseo.

(2) Discussion of USFWS Recommendations.

(a) The Corps would require the construction contractor to maintain all the most recently adopted Territory of Guam Water Quality Standards.

(b) As construction of the project is dependent upon authorization and funding by the Office of the Chief of Engineers, the scheduling cannot be made in advance of the fishing season. To minimize effects of construction upon shoreside fishing, the contractor will be required to perform the work incrementally, fencing off the job site, in order to leave the remainder of the shoreline open to fishing.

(c) Landscaping will be the responsibility of the Government of Guam.

(d) Any project feature mitigating for lost access to the shoreline for fishing would be a locally-borne cost. Solid concrete caps, ramps or stairways are rigid structures compared with the stones in the revetment which can shift, within acceptable limits, under the force of large waves or typhoon sea conditions. The concrete structures would be soon damaged, and eventually

unserviceable and perhaps unsafe. As noted above in paragraphs 2a(4), 4b(2), and 4c(3), the recommended plan's two new features providing a 7-foot-wide bench on top of the revetment and the flatter grade-and-fill will increase access to the water's edge for people of all ages. The level of safety of the new accessibility remains questionable. No stairway would be provided on the eastern revetment. Access to the shallow water would be limited to climbing down the revetment slope or entering the water south of the revetment and walking close to the shoreline around the man-made Agana River channel.

(e) The proposed improvements will have minimal impact on view planes from the park. The western shoreline revetment has a crest elevation of +7.0 feet MLLW, corresponding to the average ground elevation within the park. The east shoreline revetment has a crest elevation of +10.0 feet MLLW, which ranges from 0.5 feet to 3.0 feet high above the ground at the northeast tip of the park.

(f) See paragraph 2(b) above.

g. Adverse Environmental Effects That Cannot be Avoided. There are no unavoidable adverse effects of the recommended plan except for intermittent noise and movement of dust during construction and possible interference with shoreline fishing in the immediate zone of work.

h. List of Mitigation Measures to Reduce or Avoid Environmental Effects. The recommended Plan 3 has been redesigned to incorporate most of the measures which were recommended by the U.S. Fish and Wildlife Service, U.S. National Marine Fisheries Service, and Government of Guam officials at the Public Meeting of July 7, 1983. Other mitigative measures are listed in paragraph 4f(2) above.

## 5. PUBLIC INVOLVEMENT

### a. Agencies Consulted.

Guam Bureau of Planning

Guam Department of Parks and Recreation (including State Historic Preservation Officer staff).

Guam Department of Agriculture, Aquatic and Wildlife Resources Division

Guam Environmental Protection Agency

Guam Visitor Bureau

U.S. Fish and Wildlife Service, Department of the Interior

U.S. National Marine Fisheries Service

### b. Individuals Consulted

Anonymous group of student picnickers at Paseo de Susana

c. Public Coordination

Appendix B, PUBLIC INVOLVEMENT PROGRAM, contains a list of agencies, groups, and individuals receiving copies of the Draft Detailed Project Report and Environmental Assessment, as well as copies of review comments and responses to those comments. A public meeting was held in Agana, Guam on July 7, 1983 with five Corps and nine Government of Guam officials attending. No other members of the general public attended. Significant issues discussed include public safety aspects of the proposed plan and suggestions to fence the planned stone bench feature or design it with a raised lip. Effect of erosion on water quality was also discussed.

d. Relationship of Plans to Environmental Protection Statutes. See Table EA-1.

6. LIST OF PREPARERS

The following people were primarily responsible for preparing this Final Environmental Assessment:

| <u>Name</u>      | <u>Discipline/Expertise</u>                                     | <u>Experience</u>                                                                                                                                          | <u>Role in Preparing EA</u>                           |
|------------------|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| David G. Sox     | Social Environmental Specialist/Historical & Cultural Geography | BA, MA, Geography<br>6 yrs research<br>8 yrs EIS studies with US Army Corps of Engineers                                                                   | Social and Cultural Resource Assessment; EA Preparer. |
| John I. Ford     | US Fish and Wildlife Service, Fishery Biologist/Limnology       | BS, MS, Zoology<br>6 yrs research<br>4 yrs EIS studies with the US Army Corps of Engineers<br>2 yrs with US Fish and Wildlife Service                      | Fish and Wildlife Assessment                          |
| James E. Maragos | Supervisory Environmental Biologist/Marine Ecology              | BS, Zoology, PhD, Oceanography<br>2 yrs Post-Doctoral Research;<br>9 yrs Environmental Consultant<br>8 yrs EIS studies with the US Army Corps of Engineers | NEPA Coordinator                                      |
| George P. Young  | Hydraulic Engineer                                              | BS, MS, Civil Engineering<br>3 yrs Civil/Hydraulic Engineering with the US Army Corps of Engineers                                                         | Study Manager                                         |

TABLE EA-1. Relationship of Plans to Environmental Protection Statutes and Other Requirements

| <u>Federal Statutes</u>                           | <u>Plan 1</u>   | <u>Plan 2</u>   | <u>Plan 3</u>   |
|---------------------------------------------------|-----------------|-----------------|-----------------|
| Archaeological and Historic Preservation Act      | Full Compliance | Full Compliance | Full Compliance |
| Clean Air Act                                     | Full Compliance | Full Compliance | Full Compliance |
| Clean Water Act <sup>1</sup>                      | Full Compliance | Full Compliance | Full Compliance |
| Coastal Zone Management Act <sup>1</sup>          | Full Compliance | Full Compliance | Full Compliance |
| Endangered Species Act <sup>2</sup>               | Full Compliance | Full Compliance | Full Compliance |
| Estuaries Protection Act                          | Not Applicable  | Not Applicable  | Not Applicable  |
| Federal Water Project Recreation Act <sup>2</sup> | Full Compliance | Full Compliance | Full Compliance |
| Fish and Wildlife Coordination Act <sup>2</sup>   | Full Compliance | Full Compliance | Full Compliance |
| Land and Water Conservation Fund Act              | Not Applicable  | Not Applicable  | Not Applicable  |
| Marine Protection, Research and Sanctuaries Act   | Not Applicable  | Not Applicable  | Not Applicable  |
| National Historic Preservation Act <sup>3</sup>   | Full Compliance | Full Compliance | Full Compliance |
| National Environmental Policy Act                 | Full Compliance | Full Compliance | Full Compliance |
| Rivers and Harbors Act                            | Not Applicable  | Not Applicable  | Not Applicable  |
| Watershed Protection and Flood Prevention Act     | Not Applicable  | Not Applicable  | Not Applicable  |
| Wild and Scenic Rivers Act                        | Not Applicable  | Not Applicable  | Not Applicable  |

Executive Orders, Memoranda, Etc.

|                                                                    |                 |                 |                 |
|--------------------------------------------------------------------|-----------------|-----------------|-----------------|
| Floodplain Management (E.O. 11988) <sup>1</sup>                    | Full Compliance | Full Compliance | Full Compliance |
| Protection of Wetlands (E.O. 11990) <sup>1</sup>                   | Not Applicable  | Not Applicable  | Not Applicable  |
| Environmental Effects Abroad of Major Federal Actions              | Not Applicable  | Not Applicable  | Not Applicable  |
| Analysis of Impacts on Prime and Unique Farmlands (CEQ Memorandum) | Not Applicable  | Not Applicable  | Not Applicable  |

Territorial Policies

|                                                        |                 |                 |                 |
|--------------------------------------------------------|-----------------|-----------------|-----------------|
| Guam Coastal Zone Management Program <sup>1</sup>      | Full Compliance | Full Compliance | Full Compliance |
| Guam Flood Hazard Areas (Guam E.O. 78-20) <sup>1</sup> | Full Compliance | Full Compliance | Full Compliance |
| Guam Land Use Districts (Guam E.O. 78-23)              | Full Compliance | Full Compliance | Full Compliance |
| Guam Protection of Wetlands (Guam E.O. 78-21)          | Not Applicable  | Not Applicable  | Not Applicable  |

Notes:

- Full - Full compliance, having met all requirements of the statute, E.O. or other environmental requirements for the current stage of planning (either pre- or post-authorization).
- Partial - Partial compliance, not having met some of the requirements that normally are met in the current stage of planning.
- NC - Non-compliance, or violation of a requirement of the statute, E.O. or other environmental requirement.
- NA - Not Applicable, there is no requirement for the statute, E.O. or other environmental requirement for the current stage of planning.

1. See Appendix A; Sec 401 Water Quality Certificate being sought.

2. See Appendix C.

3. No coordination letter received from State Historic Preservation Officer with statutory time limit; otherwise in full compliance.

## 7. FINDING OF NO SIGNIFICANT IMPACT (FONSI)

### PASEO DE SUSANA SHORE PROTECTION STUDY AGANA, TERRITORY OF GUAM November 1983

1. DESCRIPTION OF THE PROPOSED ACTION. The project site is the man-made Paseo de Susana peninsula at Agana, Guam. The recommended plan consists of constructing a 500-foot long rubblemound revetment on the northeast tip of the peninsula. This revetment would have a crest elevation of +10 feet (MLLW) but rise only 1 to 4 feet above ground level. The revetment would have a seaward slope of 1.5 to 1 and consist of 1.25 to 2 ton armor stones. Another 970-foot long rubble mound revetment would be constructed on the west shoreline of the Paseo peninsula. An armor layer of 500 to 1,000-lb stone sloping at 1.5 to 1 would provide an average 7-foot wide lip at +3 feet (MLLW). This would be topped by a gradually sloping (5.0 to 1) layer of soil and salt-resistant grass reaching a crest elevation of +7 feet (MLLW) even with ground level. Two alternative plans included the above 500-foot revetment and also two 970-foot and 590-foot long rubble mound revetments on the western shore of the peninsula. These were rejected because they were too expensive in relation to benefits.

## 2. BASIS FOR FINDING.

a. The Paseo de Susana shore protection project site is not a wetland, a special aquatic site, municipal water supply area, harvestable shellfish area, fish spawning or nursery area, a wildlife habitat area, nor a habitat for threatened or endangered species. It is an important fishery and a formal recreational area.

b. Pursuant to the National Historic Preservation Act of 1966 as amended, an historical analysis of the project site found only one historic site in the project vicinity, a World War II-era Japanese pillbox which is listed on the Guam Register of Historic Places. The proposed plan will not adversely affect this site and should protect it from future erosion. The Guam Historic Preservation provided no comments on these findings.

c. Neither the U.S. Fish and Wildlife Service nor the U.S. National Marine Fisheries Service reported any endangered or threatened species in the immediate project area. The Guam Aquatic and Wildlife Resource office previously observed locally-threatened Micronesian starlings in the palm trees bordering Agana marina. The project will not affect these birds.

e. Analysis of the recommended plan under the Clear Air Act Amendments of 1977 and the Noise Control Act 1972 finds the project will make only temporary and intermittent changes to ambient air and noise

conditions. There should be no more effect on the locally-threatened Micronesian starling than from existing ambient traffic noise.

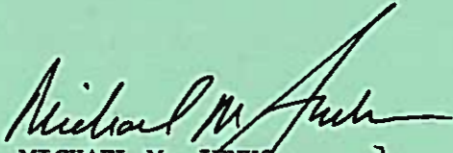
f. The recommended plan is compatible with both the coastal Flood Hazard Zone and Agana Bay Urban Waterfront areas of particular concern (APC's) as designated under the Guam Coastal Management Program (CMP). The plan is also consistent with the overall objectives of the Guam CMP.

h. The portions of the recommended Plan 3 on the western shoreline of the Paseo peninsula as originally designed and described in the Draft Detailed Project Report and Environmental Assessment would have had local adverse effects on water quality during and after construction and would probably have interfered with seasonally popular hook-and-line fishing activity. Public comments at the public meeting held July 7, 1983 in Agana also raised concerns about the threat of drowning in deep waters off the western shore of the peninsula. The current recommended plan has been redesigned to minimize these problems. Placement of rock instead of soil in the Agana marina waters should eliminate severe water pollution during construction. Flattening the vegetated slope atop the revetment from 3.5:1 to 5.0:1, vegetating it with a salt-resistant grass such as Seashore paspalum or Bermuda grass, and providing an average 7-foot rock bench at the base of the grassed slope should significantly reduce long-term erosion and intermittent rises in turbidity offshore. Access to the shoreline for fishermen will be easy and relatively safe and snagging of lines reduced.

i. In response to U.S. Fish and Wildlife Service and U.S. National Marine Fisheries Service recommendations, project construction will comply with Territory of Guam Water Quality Standards, construction will be performed to minimize interference with the atulai and manahac fishing seasons and redesign of the project should provide adequate access to the shoreline for fishermen and strollers alike.

h. There are no significant adverse project effects pursuant to Section 122 of the River and Harbor Act of 1970. The redesigned plan minimizes visual intrusion.

3. FINDING. Based on the above factors, the US Army Corps of Engineers finds that the Paseo de Susana Shore Protection Project does not constitute a major Federal action significantly affecting the quality of the environment. An Environmental Impact Statement will not be prepared for this project.

  
MICHAEL M. JENKS  
Colonel, Corps of Engineers  
District Engineer

**PASEO DE SUSANA SHORE PROTECTION  
TERRITORY OF GUAM**

**PLAN FORMULATION CRITERIA  
AND  
COMPLIANCE REPORTS**

APPENDIX A  
PLAN FORMULATION CRITERIA  
AND  
COMPLIANCE REPORTS

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## I. STUDY AUTHORITY

### SHORE PROTECTION PROJECT AUTHORITY

#### a. Legislative Authority.

Section 103a of the River and Harbor Act of 1962, as amended by Section 310 of the River and Harbor Act of 1965, Sections 112 and 208 of the River and Harbor Act of 1970, and Section 133(a) of the Water Resources Development Act, approved 22 October 1976, states:

"The Secretary of the Army is hereby authorized to undertake construction of small shore and beach restoration and protection projects not specifically authorized by Congress, which otherwise comply with section 1 of this Act, when he finds that such work is advisable, and he is further authorized to allot from any appropriations hereafter made for civil works, not to exceed \$25,000,000 for any one fiscal year for the Federal share of the costs of construction of such projects: Provided, That not more than \$1,000,000 shall be allotted for this purpose for any single project and the total amount allotted shall be sufficient to complete the Federal participation in the project under this section including periodic nourishment as provided for under section 1(c) of this Act: Provided further, That the provisions of local cooperation specified in section 1 of this Act shall apply: And provided further, That the work shall be complete in itself and shall not commit the United States to any additional improvement to insure its successful operation, except for participation in periodic beach nourishment in accordance with section 1(c) of this Act, and as may result from the normal procedure applying to projects authorized after submission of survey reports."

## II. PLANNING CRITERIA AND CONSTRAINTS

Institutional Policies. Several institutional policies of the Federal government affect the design and decisions for local and Federal participation. Executive policies are issued through the Office of Management and Budget (OMB), the Water Resources Council (WRC) and the Council of Environmental Quality (CEQ). Legislative policies are expressed by various legislative enactments of Congress which has developed a body of laws establishing national concerns regarding the nation's natural resources.

Design/Benefit Criteria. In developing justification for Federal participation, technical and economic evaluation policies, standards, principles, and procedures are established in determining a benefit to cost comparison. All projects must have a benefit to cost comparison. Projects must usually have a benefit to cost comparison of one or greater to be eligible for federal participation.

Regulatory/Environmental Requirements. A number of statutory and regulatory requirements of the Federal government must be complied with during the planning process. These requirements largely relate to the assessment and evaluation of possible impacts on the environmental resources of the project area.

Archaeological and Historic Preservation Act of 1974 (Public Law 93-291) as amended. The Act, also known as the Reservoir Salvage Act, provides for the preservation of historical and archaeological data which might be otherwise destroyed by flooding or other alteration of the terrain and authorizes up to one percent of the total amount authorized for appropriation for the project to be spent on recovery, protection and preservation of data. This act will be utilized only for sites eligible for or listed on the National Register of Historic Places. Applicability of this act to the project will be assessed in the ES.

Clean Air Act, as amended (42 USC 7401 et seq.). As it applies to Corps studies and construction projects, this act requires that all federal projects must conform to EPA approved or promulgated state implementation plans. Compliance with this act will be addressed in the ES.

Estuary Protection Act (Public Law 90-454). The act requires that Federal agencies in planning for use or development of water and land resources, give consideration to estuaries and their natural resources and that if estuaries may be affected, the Secretary of the Interior shall be given an opportunity to evaluate the effects of the project on the estuary. There are no estuaries in the study area.

Federal Water Project Recreation Act (Public Law 89-72, as amended). This act requires that full consideration be given to project opportunities for outdoor recreation and fish and wildlife enhancement; that planning based on coordination for use with existing and planned Federal and local public recreation developments; that the views of governmental agencies concerned with recreation and wildlife, including the USFWS and Heritage Conservation and Recreation Service (HCRS) be included in the report.

Land and Water Conservation Fund Act of 1965 (16 USC 4601-4 et seq). As it applies to Corps studies and project, this act requires that Corps recreation planning be coordinated with the State plan developed pursuant to the Act. For Guam this is the Guam Comprehensive Outdoor Recreation Plan. Moreover, the non-Federal cost for the project may not be paid out of LWCFA funds.

Rivers and Harbors Appropriation Act of 1899, as amended (33 USC 401 et seq.). This statute, which established Corps' regulatory responsibilities and generally prohibited a wide range of actions which might obstruct navigable waters of the United States, does not impose any requirements on projects that are affirmatively authorized by Congress.

Watershed Protection and Flood Prevention Act, as amended (16 USC 1001 et seq.). This statute which authorized the Soil Conservation Service to construct dams and other works in upstream watersheds, imposes no requirements on Corps projects.

National Environmental Policy Act of 1969 (Public Law 91-190). The National Environmental Policy Act (NEPA) requires an environmental statement in every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the human environment.

Clean Water Act of 1977 (Public Law 95-217). This act was formerly known as the Federal Water Pollution Control Act Amendments of 1972. The requirement is to evaluate discharge effects of dredged or fill materials into waters of the United States.

Coastal Zone Management Act of 1972 (Public Law 92-583). This act requires that the project must comply with the federal law as well as be consistent with the Coastal Management Program for the Territory of Guam (Guam E.O. 78-37: Compliance with the Guam Coastal Management Program Policies).

Endangered Species Act of 1973 (Public Law 93-205). The implementing agency shall coordinate with the appropriate federal wildlife agency to determine the presence of listed endangered or threatened species or their critical habitat may be present in the area of proposed action. The results of the assessment shall be contained in the ES.

Fish and Wildlife Coordination Act of 1958 (Public Law 85-624). This act requires any federal agency proposing to impound, divert, or modify the channel of any stream or other body of water to consult with the Department of Interior, U.S. Fish and Wildlife Service (USFWS) and the head of the state or territorial agency exercising control over fish and wildlife resources, concerning the impacts of such action. The USFWS shall recommend, in a 2(b) report, methods to mitigate impacts of the proposed action and to conserve fish and wildlife resources.

Marine Protection, Research, and Sanctuaries Act of 1972 (Public Law 92-532). This act regulates the evaluation of the need and transportation of dredged material for the purpose of dumping in ocean waters. In the case of this project, there is no specific need to provide an ocean dump site for excess construction materials.

National Historic Preservation Act of 1966 (Public Law 89-635). Section 106 of this act requires that federal agencies shall, prior to the approval of the expenditure of any funds on an undertaking, or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any property included in, or eligible for inclusion in the National Register and shall afford the Advisory Council on Historic Preservation a reasonable opportunity to comment with regard to such undertaking. The Commonwealth Historic Preservation Officer must also be given a reasonable opportunity to comment on the undertaking.

Executive Order on Floodplain Management (EO 11988). This order requires that agencies avoid the base floodplain unless it is the only practicable alternative. For potential action in the floodplain, an evaluation of effects on floodplain values, a description of other practicable alternative actions outside the floodplain, and adequate dissemination of the action to the public must be undertaken.

Executive Order on Protection of Wetland, (EO 11990). This order requires the agency to analyze potential impacts to existing wetlands and associated values and to give the public early public review of proposed actions.

Wild and Scenic Rivers Act of 1968 (Public Law 90-542). This act requires agencies to identify potential impacts to designated wild and scenic rivers and to coordinate action and obtain concurrence with the U.S. Department of the Interior.

### III. PRESIDENTIAL EXECUTIVE ORDER 11988 ON FLOODPLAIN MANAGEMENT EVALUATION REPORT

1. The purpose of this supplemental report is to present the results of additional studies required by Executive Order 11988, Flood Plain Management, dated 24 May 1977. The objective of EO 11988 is to avoid to the maximum extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The Order requires Federal agencies to:

- a. Avoid use of the base floodplain unless it is the only practicable alternative;
- b. Reduce the hazard and risk of flood loss;
- c. Minimize the impact of floods on human safety, health, and welfare; and
- d. Restore and preserve the natural and beneficial floodplain values.

#### 2. PROCEDURE

The basic determinations necessary to implement EO 11988 are stated in Section 2 of the EO and are summarized in the following paragraphs:

- a. Determine whether the proposed action is the base floodplain. The base floodplain is defined in Section 6 of EO 11988 as the area inundated by a flood with a 1 percent chance of occurrence in any given year.
- b. Determine whether there is a practicable alternative to locating the action in the base floodplain. The "action" is any Federal activity including (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.
- c. Identify adverse impacts due to the action and any induced development and identify losses of natural and beneficial values of the floodplain.

d. If the proposed action induces development in the base floodplain, determine if there is a practicable alternative to the development. The decision on whether a practicable alternative exists is to be based on the advantages and disadvantages of floodplain and non-floodplain sites. Factors to be considered include water resources; conservation; economics; aesthetics, natural and beneficial values served by the floodplains; impacts of floods on human safety; locational advantage relative to availability of housing, education, and work force; the functional need for locating the development in the flood plain; historic values; fish and wildlife habitat values; endangered and threatened species; support of municipal infrastructure; energy conservation; cost effectiveness; enhancement of work opportunities for economically disadvantaged minorities; and in general the needs and welfare of the people.

e. Determine viable methods to minimize the adverse impacts of the action and any induced development and methods to restore and preserve the natural and beneficial values of the floodplain.

f. Advise the general public if the proposed action will be located in the floodplain.

g. Recommend the most desirable plan responsive to the established planning objectives and consistent with the requirements of the Executive Order.

## DESCRIPTION OF FACTORS FOR THE SELECTED PLAN

### 1. PROPOSED ACTION LOCATION

The proposed action in the area is located within the base floodplain limits. The base floodplain is defined as the one percent (1%) exceedance frequency floodplain.

### 2. EXISTING FEDERAL ACTIVITIES ON GUAM

a. Floodplain management services are available from the U.S. Army Corps of Engineers under the authority of Section 206 of the Flood Control Act of 1960 (Public Law 86-645). These services include providing flood hazard data, maps and technical assistance and studies.

b. A flood insurance program is available by the U.S. Federal Emergency Management Agency (FEMA) through the Federal Insurance Administration under the authority of the National Flood Insurance Act of 1968, as amended. The Government of Guam is in the emergency phase of the flood insurance program, which requires them to establish some building permit review process.

c. The U.S. Department of Housing and Urban Development (HUD) has minimum building standard requirements for federally subsidized housing projects administered by the agency.

d. Emergency and disaster operations, when in effect are administered by FEMA. Disaster recovery assistance includes protection of life and property, damage surveys, restoration of public services, and technical assistance. This assistance was given for the effects of Typhoon Pamela in 1976.

e. Relocation assistance for persons displaced as a result of federal and federally-assisted programs are authorized by the Uniform Relocations Assistance and Real Property Acquisition Act of 1970 (Public Law 91-646). This statute provides moving and related expenses to insure fair and equitable treatment of displaced persons.

f. The U.S. Army Corps of Engineers is currently conducting an overall planning effort under the Guam Comprehensive Study. Among the water resource problems and needs addressed by this study are regional harbors, water supply, floodplain management, shore protection and beach erosion. The study was initiated in FY 1979 and is expected to extend over a five-year period.

### 3. POTENTIAL FLOODPLAIN DEVELOPMENT WITH THE PROJECT

The project is not expected to contribute to further development of adjacent floodplain lands in Agana.

### 4. POTENTIAL LOSSES TO THE NATURAL AND BENEFICIAL RESOURCES

All the natural resources present are subject to flood damage and are not dependent upon the flood occurrences for their continued survival. Potential loss of habitats is not considered to be significant to affect productivity or diversity of any existing ecosystem.

The revetment will provide rocky intertidal and interstitial habitat possibly creating an increase in species and habitat density. Coastal strand vegetation along the shoreline will be cleared for access and operations during construction resulting in a minimal loss of vegetative habitat.

### 5. DESCRIPTION OF THE BEST NON-FLOOD ALTERNATIVE FOR POTENTIAL DEVELOPMENT

The no-action plan would be inconsistent with the study planning objectives. The inherent nature of shore protection measures requires action in floodplains.

### 6. DESCRIPTION OF WHY THE PROPOSED ACTION WHICH WILL HAVE SOME NEGATIVE ENVIRONMENTAL IMPACTS AND ADDED FLOOD DAMAGE POTENTIAL DUE TO INDUCED DEVELOPMENT IN THE FLOODPLAIN IS THE PREFERRED SOLUTION

The proposed action will neither induce further development nor add flood damage potential in the floodplain.

### 7. DESCRIPTION OF ACTIONS THAT WILL BE CONSIDERED PRIOR TO CONSTRUCTION TO MINIMIZE DAMAGE TO BOTH THE NATURAL VALUES OF THE FLOODPLAIN AND DAMAGES TO DEVELOPMENT INDUCED BY THE PROJECT

a. The design of the shore protection structures would minimize adverse drainage characteristics and losses to marine life within the project area.

b. Any proposed action will be in conformance to all applicable Federal and local land-use, water and related resources regulations and laws.

**8. ADVISEMENT OF THE GENERAL PUBLIC THAT THE PROPOSED ACTION WILL BE LOCATED IN THE FLOODPLAIN**

The general public will be informed of this action by public notice and will have the opportunity to address and comment on this action during a formal public meeting.

**9. RECOMMENDATION OF THE MOST DESIRABLE PLAN RESPONSIVE TO THE ESTABLISHED PLANNING OBJECTIVES CONSISTENT TO THE REQUIREMENTS OF THE EXECUTIVE ORDER**

Plan 3 is the tentatively recommended plan because it maximizes net benefits. Table A-1 summarizes the advantages and disadvantages of utilizing the floodplain.

TABLE A-1. EXECUTIVE ORDER 11988 - EVALUATION OF FLOODPLAIN SITE

| <u>Factor</u>                                                         | <u>Advantage of Floodplain Site</u>                                         | <u>Disadvantage of Flood Plain Site</u>                                                                    |
|-----------------------------------------------------------------------|-----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| <u>National Economic Development (NED)</u>                            |                                                                             |                                                                                                            |
| Functional Need                                                       | Water-related recreational activities are dependent upon coastal locations. | None                                                                                                       |
| Relationship to Existing/Proposed Development                         | Human activities are concentrated in the coastal zone.                      | None                                                                                                       |
| Benefits                                                              |                                                                             | Periodic flooding damage.                                                                                  |
| <u>Environmental Quality (EQ)</u>                                     |                                                                             |                                                                                                            |
| Wildlife Habitat Values                                               | Does not affect upland habitats.                                            | Affects and impacts upon coastal habitat.                                                                  |
| Endangered or Threatened Species                                      | Not Applicable                                                              | Not Applicable                                                                                             |
| Commercial or Recreational Species                                    | Enhances commercial and recreational fishing opportunities.                 | None                                                                                                       |
| Natural Reserve Area                                                  | None                                                                        | None                                                                                                       |
| Historic & Recreational Values, Historical & Archaeological Resources | None                                                                        | Some potential for disturbance.                                                                            |
| Parks & Recreational Area                                             | Improves water-contact recreational opportunities.                          | Facilities exposed to flood hazards.                                                                       |
| Water Resource Values                                                 |                                                                             |                                                                                                            |
| Water Supply & Conservation                                           | None                                                                        | None                                                                                                       |
| Water Quality                                                         | None                                                                        | May temporarily degrade water quality during construction, which would place stress upon coastal habitats. |
| Agricultural & Food Production                                        | Does not affect agricultural lands.                                         | None                                                                                                       |

TABLE A-1. EXECUTIVE ORDER 11988 - EVALUATION OF FLOODPLAIN SITE (Cont)

| <u>Factor</u>                  | <u>Advantage of Floodplain Site</u>                                      | <u>Disadvantage of Flood Plain Site</u>            |
|--------------------------------|--------------------------------------------------------------------------|----------------------------------------------------|
| <u>Social Well-Being (SWB)</u> |                                                                          |                                                    |
| Safety                         | None                                                                     | Coastal area exposed to flood hazards.             |
| Locational Advantage           | Water-related recreational activities are dependent on coastal location. | Coastal area exposed to flood hazards.             |
| Community Welfare              |                                                                          | None                                               |
| Aesthetic Values               | Coastal zone location of park may enhance recreational experience.       | May degrade aesthetic appeal of an open coastline. |

IV. EVALUATION OF THE EFFECTS OF THE  
DISCHARGE OF DREDGED OR FILL MATERIAL INTO  
WATERS OF THE U.S. USING U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)  
SECTION 404 (b) GUIDELINES

1. Project Description.

a. Description of the proposed material discharge.

- |                                              |                                                                                            |
|----------------------------------------------|--------------------------------------------------------------------------------------------|
| (1) General Characteristics of the Material. | Quarried limestone ranging in size from spall to 1 ton boulders and indigenous soils.      |
| (2) Quantity of Material to be Discharged.   | Plan 1 - 11,931 cubic yards.<br>Plan 2 - 9,132 cubic yards.<br>Plan 3 - 5,873 cubic yards. |
| (3) Source of the Material.                  | Existing quarries on Guam                                                                  |

b. Description of the proposed discharge site.

- |                                                        |                                                                                                                                                                                           |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (1) Location.                                          | Paseo de Susana Park.                                                                                                                                                                     |
| (2) Type of discharge site.                            | Nearshore reef site and shoreline location.                                                                                                                                               |
| (3) Method of discharge.                               | Material will be used to construct shoreline protective structures at the discharge site. The material will be placed by cranes and bulldozers to form the revetments or soil embankment. |
| (4) Date and length of time when discharge will occur. | The project will be implemented within 2 years. Plans will take approximately 9-12 months to construct.                                                                                   |
| (5) Life of the discharge site.                        | Revetment component of plans has an economic life of 50 years.                                                                                                                            |

2. Physical Effects.

- |                                          |                                                                                           |
|------------------------------------------|-------------------------------------------------------------------------------------------|
| a. Potential Destruction of Wetlands.    | Site is not considered a wetland.                                                         |
| b. Other Physical Effects.               |                                                                                           |
| (1) Area of bottom covered by discharge. | Plan 1 - less than 0.5 acre<br>Plan 2 - less than 0.5 acre<br>Plan 3 - less than 0.5 acre |

- |                                                                         |                                                                                                                                                             |
|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (2) Changes in bottom geometry and substrate composition.               | The bottom substrate consists of coralline material and sands derived from old terrestrial fill material.                                                   |
| (3) Water circulation and flushing.                                     | The protective structures will have no effect on water circulation in Agana Bay.                                                                            |
| (4) Salinity distribution and gradients.                                | No alterations are anticipated because discharge does not involve a release of high or low salinity waters or materials.                                    |
| (5) Natural drainage characteristics, and flood and stormwater storage. | Site involves no drainage basin modifications; site has no flood or stormwater storage capability. The existing storm drainage system will not be affected. |
| (6) Groundwater levels and recharge.                                    | The site is not known as a groundwater recharge area, and the discharge is not expected to alter groundwater levels.                                        |

### 3. Chemical-Biological Interactive Effects.

a. The material proposed for discharge meets EPA exclusion criteria and no bioassay testing is required. The material to be discharged is larger than silt size, similar in composition to the substrate at the project sites, and is obtained from sources removed from pollution point-sources.

#### b. Impacts on the Water Column.

- |                                                                                                               |                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| (1) Reduction in light transmission.                                                                          | Temporary increase in water turbidity is anticipated as dust may be washed from the quarried limestone by wave action. |
| (2) Degradation of water aesthetic values.                                                                    | Only temporary effects.                                                                                                |
| (3) Direct destructive effects on nektonic and planktonic populations.                                        | Temporary disturbance and displacement during construction. Minor permanent loss of existing water column habitat.     |
| (4) Are contaminants found in the material?                                                                   | None anticipated.                                                                                                      |
| (5) Concentration of contaminants released from sediment to the water column. (Results of elutriate testing). | Material exempt from chemical and bioassay testing.                                                                    |

(6) Comparison of constituent concentrations with applicable water quality standards.

Not applicable.

(7) Size of mixing zone.

Not applicable.

c. Impacts on Benthos.

(1) Area of benthic community covered by material.

Plan 1 - less than 0.5 acre

Plan 2 - less than 0.5 acre

Plan 3 - less than 0.5 acre

(2) Changes in community structure and function.

Fill raises bottom elevation creating terrestrial, intertidal, and rocky interstitial marine habitat. Changes in community structure and function are localized and involve replacement of habitat.

(3) Effects of chemical constituents on benthos.

None anticipated.

4. Impacts of the Discharge at the Discharge Site (see Section II, Appendix D).

a. Need for the proposed action.

The discharge is needed to construct protective structures.

b. Availability of alternate discharge sites and alternate methods of discharge.

None (see Paras. 11 and 12, EIS).

c. Evaluation of Impacts.

(1) Chemical, physical and biological integrity of the aquatic eco-system.

Discharge is localized in effect, and will not affect availability of biological resources. The fill will not alter the chemical integrity and the aquatic ecosystem. Minimal destruction of habitat is anticipated. There will be an increased habitat diversity created by the rocky substrate.

(2) Food chain and trophic level.

No effect anticipated.

(3) Diversity of plant and animal species.

A localized increase in habitat and species diversity is anticipated.

(4) Obstruction of movement into and out of feeding, spawning, breeding and nursery areas.

Not applicable.

|                                                                                    |                                                                                                               |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| (5) Wetlands having significant functions of water quality maintenance.            | Not applicable.                                                                                               |
| (6) Natural highwater or flood water storage.                                      | Not applicable.                                                                                               |
| (7) Degradation of Water Quality.                                                  | Temporary increase in water turbidity anticipated during construction.                                        |
| d. Methods to minimize turbidity.                                                  | Possible use of silt screens.                                                                                 |
| e. Methods to minimize degradation of aesthetic, recreational and economic values. | See 4d.                                                                                                       |
| f. Methods investigated to minimize possible harmful effects.                      | See 4d.                                                                                                       |
| g. Impacts on water uses.                                                          |                                                                                                               |
| (1) Municipal water supply intakes.                                                | None.                                                                                                         |
| (2) Shellfish                                                                      | Negligible effect anticipated.                                                                                |
| (3) Fisheries                                                                      | Negligible effect anticipated.                                                                                |
| (4) Wildlife                                                                       | None.                                                                                                         |
| (5) Recreation Values                                                              | Improves recreational use of shoreline and idle time diversion.                                               |
| (6) Threatened and endangered species.                                             | None.                                                                                                         |
| (7) Benthic life.                                                                  | Plans will cover a minor acreage of benthic area and will create a minor acreage of rocky intertidal habitat. |
| (8) Wetlands.                                                                      | None affected.                                                                                                |
| (9) Submerged vegetation.                                                          | None affected.                                                                                                |
| (10) Size of disposal site.                                                        | Total enclosed area of Plan                                                                                   |
| (11) Coastal Zone Management Program.                                              | Conforms with Guam Coastal Management Program.                                                                |

## 5. Determination.

a. An ecological evaluation has been made following the guidance in 40 CFR 230.4 in conjunction with the evaluation considerations in 40 CFR 230.5 (40 CFR 230.3(d)).

b. Appropriate measures have been identified and incorporated into the proposed plan (see Paragraphs 24 and 29 of Section II, Appendix D) to minimize adverse effects on the aquatic environment as a result of the discharge (40 CFR 230 (d)(1)).

c. Consideration has been given to the need for the proposed activity, the available of alternative sites, methods of discharge that are less damaging to the environment, and such water quality standards as are appropriate and applicable by law (40 CFR 230.5).

d. No wetlands are affected by the proposed action.

## V. FEDERAL COASTAL ZONE MANAGEMENT CONSISTENCY DETERMINATION

The following consistency determination is prepared in accordance with the Coastal Zone Management (CZM) Act of 1972 (Public Law 92-583) and the regulations on Federal Consistency with approved Coastal Management Program (15 CFR 930). Federal activities must be consistent to the maximum extent practicable with approved State/Territorial CZM program. In September 1979 the Government of Guam's (GOVGUAM) Coastal Management Program, prepared by the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, and the Bureau of Planning, Government of Guam, was approved by the Federal government.

The determination, as documented below, specifically addresses the impacts of preliminary plans of improvement for shore protection at Paseo de Susana Park, Agana, Guam, on the Guam Coastal Management Program (GCMP). The GCMP policies were made effective 15 November 1978, GOVGUAM Executive Order 78-37 (Guam Land-Use Policies). The component items of Executive Order 78-37) are documented in the Final Environmental Impact Statement and Coastal Management Program for the Territory of Guam, July 1979. The term "project" in this consistency determination document refer to the construction of any one of three shore protection designs at Paseo de Susana unless otherwise specified.

### GOVERNMENTAL PROCESS POLICY

1. Objective: Provide an efficient, effective administration of natural resources.
2. Policy: Effectively administer the program, policies, and laws through regulatory revisions, improved interagency coordination, and improved educational and technical programs for local government personnel.
3. Consistency: The proposed project will not alter existing laws, programs, and policies.

### DEVELOPMENT POLICIES

#### 1. Shore Area Development.

- a. Objective: Assure the environmental compatibility of uses on the shore area.
- b. Policy: The location of any designated use within the shore area shall enhance, shall be compatible, and shall not generally detract from the surrounding coastal area's aesthetic, environmental quality, and beach accessibility. In addition, the dependence on the location and the lack of feasible alternative sites shall be demonstrated.
- c. Consistency: The proposed project would intrude on the visual seascape, would temporarily degrade environmental quality, but will not affect beach accessibility. Suitable alternative sites do not exist.

## 2. Urban Employment.

a. Objective: Permit development of urban type facilities only in urban designated areas.

b. Policy: Commercial, multi-family, industrial, resort/hotels, and associated support facilities shall be concentrated within urban districts as outlined in the Land-Use District Map.

c. Consistency: The proposed project will not impact on urban development.

## 3. Rural Development.

a. Objective: Permit uses of rural designated areas consistent with its development.

b. Policy: Rural districts shall be designated in which only low-density residential and agricultural uses will be acceptable. Minimum lot size for these uses should be one-half acre until adequate infrastructure, including functional sewerage, is provided.

c. Consistency: The proposed project will not impact on any rural district.

## 4. Major Facility Setting.

a. Objective: The location of major utility, fuel, and transport facilities shall consider national interests.

b. Policy: The Territory shall recognize the national interest in siting of major facilities including those associated with electric power production and transmission, petroleum refining and transmission, port and air installations, solid waste disposal, sewage treatment, and major reservoir sites.

c. Consistency: The proposed project will not affect potential sites nor affect any existing major utility, fuel, or transport facility.

## 5. Hazardous Areas.

a. Objective: Development of hazardous areas shall be consistent with the degree of risk to the community health and welfare.

b. Policy: Identified hazardous lands including floodplains, erosion-prone areas, air installation crash and sound zones, and major fault lines shall be developed only to the extent that such development does not pose unreasonable risks to the health, safety, or welfare of the people of Guam, and complies with land-use regulations.

c. Consistency: The proposed project is located in a designated flood hazard area, however, the existing land usage as a public park is consistent with the degree of hazard, and will not be altered.

## 6. Housing.

a. Objective: Promote efficient and safe housing design and development locations.

b. Policy: The Government shall encourage efficient design of residential areas, restrict such development in areas highly susceptible to natural and manmade hazards, and recognize the limitations of the island's resources to support historical patterns of residential development.

c. Consistency: The project would not affect the design or development of housing.

## 7. Transportation.

a. Objective: Promote environmentally acceptable transportation systems.

b. Policy: The territory shall develop an efficient and safe transportation system while limiting adverse environmental impacts on primary aquifers, beaches, estuaries, and other coastal resources.

c. Consistency: The proposed project may temporarily and intermittently disrupt traffic circulation on the Paseo de Susana perimeter road.

## 8. Erosion and Siltation.

a. Objective: Development shall be controlled in areas subject to erosion.

b. Policy: Development shall be limited in areas of 15 percent or greater slope by requiring strict compliance with erosion, sedimentation, and land-use district guidelines, as well as other related land-use standards for such areas.

c. Consistency: The proposed project does not impact the development of steep and erodible areas, except that Plan 3 could lead to intermittent erosion of topsoil into the waters of the Agana Marina.

## RESOURCES POLICIES

### 1. Conservation of Natural Resources - Overall Policy.

a. Objective: The natural resources of Guam shall be preserved and conserved.

b. Policy: The value of Guam's natural resources such as recreational areas, critical marine and wildlife habitats, the major source of drinking water, and the foundation of the island's economy, shall be protected through policies and programs affecting such resources.

c. Consistency: The proposed project will not affect any designated critical marine habitats, but would enhance outdoor recreation opportunities on the northwestern shore of Guam.

## 2. Air Quality.

- a. Objective: Control activities to insure high air quality.
- b. Policy: All activities and uses shall comply with all local air pollution regulations and all appropriate Federal air quality standards in order to ensure the maintenance of Guam's relatively high air quality.
- c. Consistency: During construction the proposed project could cause temporary increases in dust and particulates in the immediate vicinity of the project. The contractor will be required to implement suitable measures to control all releases to an acceptable level.

## 3. Water Quality.

- a. Objective: Maintain high water quality of potable and recreational waters and watersheds.
- b. Policy: Safe drinking water shall be assured, and aquatic recreation sites shall be protected through the regulation of uses and discharges that pose a pollution threat to Guam's waters, particularly in estuarine, reef, and aquifer areas.
- c. Consistency: Construction of the proposed plan would temporarily increase turbidity and discharge suspended solids in the reef-flat and nearshore Agana Bay waters. The contractor will be required to control such discharges so as to maintain Guam Water Quality Standards for the construction area. Drinking water will not be affected by the proposed project.

## 4. Fragile Areas.

- a. Objective: Significant cultural, terrestrial, and wildlife habitats shall be protected.
- b. Policy: Development in the following types of fragile areas shall be regulated to protect their unique character: historic and archeologic sites, wildlife habitats, pristine marine and terrestrial communities, limestone forests, and mangrove stands and wetlands.
- c. Consistency: Unique and significant cultural and wildlife sites are not expected to be affected by the proposed project.

## 5. Living Marine Resources.

- a. Objective: Marine life shall be protected in waters of Guam.
- b. Policy: All living resources within the territorial waters of Guam, particularly corals and fish, shall be protected from overharvesting and, in the case of marine mammals, from any taking whatsoever.
- c. Consistency: Use of the shoreline revetment should not significantly change the existing intermittently-heavy fishing pressure in the adjacent marine waters.

## 6. Visual Quality.

a. Objective: Scenic resources and visual quality shall be promoted and protected.

b. Policy: Preservation and enhancement of, and respect for the island's scenic resources shall be encouraged through increased enforcement of the compliance with sign, litter, zoning, subdivision, building, and related land-use laws; visually objectionable uses shall be located to the maximum extent practicable, so as not to degrade significantly views from scenic overlooks, highways, and trails.

c. Consistency: The proposed project shall affect the existing shoreline landscape. The views from no designated scenic overlooks, highways or trails should be affected by the project.

## 7. Recreation Areas.

a. Objective: The implementation of suitable recreational and scenic facilities shall be promoted.

b. Policy: The Government of Guam shall encourage development of varied types of recreation facilities located and maintained so as to be compatible with the surrounding environment and land uses; adequately serve community centers and urban areas, and protect beaches and such passive recreational areas as wildlife and marine conservation areas, scenic overlooks, parks, and historic sites.

c. Consistency: The existing land usage is as a public park. The proposed project will both protect and enhance recreational opportunities.

## 8. Public Access.

a. Objective: Public access to the shoreline and other recreational and scenic areas shall be promoted.

b. Policy: The public's right of unrestricted access shall be ensured to all non-federally owned beach areas and all Territorial recreation areas, parks, scenic overlooks, designated conservation areas and other public lands; and the agreements shall be encouraged with the owners of private and Federal property for the provisions of reasonable access to, and use of, resources of public nature located on such land.

c. Consistency: The proposed project will not impair access to the shoreline.

## 9. Agricultural Lands.

a. Objective: Agricultural lands shall be preserved for agricultural activities.

b. Policy: Critical agricultural lands shall be preserved and maintained for agricultural use.

c. Consistency: The proposed project will have no effect on existing agricultural lands in Agana District.

PASEO DE SUSANA SHORE PROTECTION  
TERRITORY OF GUAM

PUBLIC INVOLVEMENT PROGRAM

APPENDIX B  
PUBLIC INVOLVEMENT PROGRAM  
APPENDIX

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## I. PUBLIC INVOLVEMENT PROGRAM

### OBJECTIVES.

To insure that the desires and needs of the public were identified and considered, a public involvement program was developed. The public, as broadly interpreted by the U.S. Army Corps of Engineers, is any affected or interested non-Corps of Engineers entity; other federal and territorial government entities and officials; public and private organizations, and individuals. The public participation program is directed to maintaining information flow, achieving a mutual understanding and acceptance of the problems and opportunities, and attainment of interest level for proper decisionmaking.

The objectives of the public participation program are:

- a. To inform citizens of the current Corps of Engineers planning process and direction.
- b. To surface key planning issues and concerns so that they are given full consideration.
- c. To help formulate and review potential plans and improvement.
- d. To offer technical, historical, and localized information pertinent to the study.
- e. To provide a communicative forum between the Corps, local agencies, advocacy groups, and interested citizens on the subject plan and problems.

### TECHNIQUES.

The types of public participation forms used in this study were the workshop and formal meeting:

#### a. Workshop.

This meeting was an informal exchange session open to the general public. The purpose is to promote the full airing of various views in recognition of current Corps' planning efforts. Public information notices and fact sheets are issued to all interested parties prior to the meeting.

#### b. Public Meeting.

A formal public meeting was held following completion of the draft DPR. The purpose was to notify all interested parties of the planning effort to date and to obtain specific views on various items of the agenda. The meeting, presided by the District Engineer, includes a summary of findings to date, an informal question and answer period, a presentation of formal statements by others, and tentative conclusions. A public notice of the meeting was issued to the media and the general public invited. All information and testimony has been documented as part of the planning record.

## ACTIVITIES CONDUCTED.

Detailed studies of possible shore protection measures at the Paseo de Susana Park were initiated in early 1982 at the request of the Government of Guam. A public workshop was held on 18 November 1982 to obtain public views and comments on preliminary alternative plans for shoreline protection measures. A Draft Detailed Project Report and Environmental Assessment was circulated to Federal and local government agencies, elected officials, and interested groups and individuals for their review and comments. A public meeting was held on 7 July 1983.

## FUTURE COORDINATION.

The Final Detailed Project Report and Environmental Assessment including a Findings of No Significant Impact (FONSI) will be distributed for public review after approval by the Office of Chief of Engineers (OCE). The District Engineer will issue a notice of availability for the FONSI to the general public. After a thirty-day review period, a "record of decision" will be documented by OCE.

## II. PUBLIC WORKSHOP

A public workshop was held on 18 November 1982 in the Pacific Daily News Building, Agana, Guam. Public notices were sent to Federal and local agencies, as well as to the public through local newspapers.

### ATTENDANCE AT THE PUBLIC WORKSHOP 18 November 1982

#### Federal, Corps of Engineers

Mr. George Young

#### Government of Guam

Mr. Daniel L. Guerrero, Asan/Maina Village Commissioner  
Mr. Robert D. Anderson, Department of Agriculture, Division of Aquatic and Wildlife Resources  
Ms. Christie Anderson, Guam Environmental Protection Agency  
Ms. Betty S. Guerrero, Director, Bureau of Planning  
Mr. Cliff Kindel, Bureau of Planning  
Mr. Willie Aguon, Bureau of Planning  
Mr. Fred Carl Santos, Department of Commerce  
Mr. Jerry C. Perez, Department of Commerce  
Mr. Tony Quinata, Public Utility Agency of Guam  
Mr. Tony Ramirez, Department of Parks and Recreation

#### Individuals

None attending

## SUMMARY.

The Corps of Engineers reviewed the study background and process and briefed the participants on its current status. An open discussion on the need for shore protection measures at the park and their impact on the marine and shoreline environment. No objections were raised over the implementation of structural as opposed to nonstructural shore protection measures. Concerns were voiced over compatibility of shore protection measures with both existing and proposed uses of the park shoreline.

## III. PUBLIC MEETING

A public meeting presided by the District Engineer was held on 7 July 1983 in the Pacific Daily News Building, Agana, Guam. Public notices were sent to Federal and local agencies, as well as to the public through local newspapers.

### ATTENDANCE AT THE PUBLIC MEETING

#### Federal, Corps of Engineers

COL Alfred J. Thiede, District Engineer  
LTC Byron E. Byerley, Deputy District Engineer  
Mr. George Young  
Mr. Frank Rezac  
Ms. Lyndee Sato

#### Government of Guam

Ms. Christie Anderson, Guam Environmental Protection Agency  
Mr. Robert D. Anderson, Department of Agriculture, Division of Aquatic & Wildlife Resources  
Mr. Cliff Kindel, Guam Coastal Management Program, Bureau of Planning  
Mr. Richard F. Kosario, Planning Division, Department of Land Management  
Mr. David T. Lotz, Office of the Governor of Guam  
Mr. Mike Molina, Department of Agriculture, Division of Aquatic & Wildlife Resources  
Mr. Sebastian Ongesii, Guam Coastal Management Program, Bureau of Planning  
Mr. Richard H. Randall, Marine Laboratory, University of Guam  
Mr. Pedro Terlane, Department of Land Management

#### Individuals

None attending

PASEO DE SUSANA SHORE PROTECTION  
PUBLIC MEETING  
7 July 1983

COL Thiede: Good evening and Hafa Adai everyone. I'm Al Thiede, Colonel Al Thiede from the Honolulu District, Corps of Engineers. On behalf of General Bunker and everyone else in the Honolulu District, Pacific Ocean Division, I would like to welcome you to this public meeting on Paseo de Susana Shore Protection Works, which we hope to get constructed some time in the near future if everybody agrees with our concept. As far as I know, everyone here is connected with the local or Federal government in some way. So, unless anyone has any objections, we'll skip the formalities in the interest of time as far as going through the features of the project and explaining the public meeting procedure. Does anyone have any objections or are there anyone who'd like to be brought up to date on the project? We passed out a number of detailed project reports and environmental assessment for review. Is there anyone in the room who hasn't had a chance to look at this or at least had an opportunity to look at our public meeting notice which covers a synopsis of what the project is all about? The purpose of the public meeting, actually there's two purposes, the first one of course is to disseminate information on the project. I think we'll skip that since everyone here obviously has a good feel of what the project is all about. The second aspect of the meeting is to collect information for feedback from anyone, whether you're connected with the Government or not or just representing an organization purely as a private citizen, and we're looking for any type of input, socioeconomic, technical engineering, archaeological, historical, environmental, you name it any area you can touch upon that might possibly affect one of our projects we want to know about. We're looking for the best synthesized product that we can get as an end product. So with that in mind, each and everyone of you, if you so desire, will have an opportunity to speak. A lot of you indicated initially that you didn't want to speak when you filled out these blue cards, and incidentally I hope everyone has filled out one of these blue cards. Is there anyone in here who hasn't? Although you indicated initially you don't want to speak, after you hear a couple of people who did indicate they wanted to speak you may change your mind and of course you're free to do that at any time. For those people who are speaking, I'd like to caution you and remind you that we are recording this session and also it's going to be transcribed verbatim. There will be an official record made

of these proceedings and that record will be made available for the public in the near future as soon as it's compiled. Further, if you don't make any statements now but later on you decide you want to provide some input, you've got thirty days to send an input in to me in care of Honolulu District. So, without further ado I think we'll move on to the individuals who indicated they wanted to speak. The first person we'll hear from is Dave Lotz, who's the Administrative Assistant, I'm sure all of you know, to the Governor. Dave?

David Lotz: Well, I just wanted to mention one particular item that was discussed earlier this afternoon when the representatives of the Army Corps of Engineers met with the Governor and that's that this project really should be considering its relationship with the Governor's proposed Agana Bay Development Plan.

COL Thiede: Right. I am in full agreement with that. In fact I mentioned to the project manager that we definitely needed to do that, not only on this project but on all our projects. Anything else Dave?

David Lotz: No, that's really about it.

COL Thiede: Okay, next then I'd like to hear from Mike Molina, who is with the Aquatic & Wildlife Resources, element of the Guam Dept. of Agriculture.

Mike Molina: I wanted to say that, that area in general is kind of a unique asset for the fishermen of the island because it's so essentially located and makes the reef flat so easily accessible in waters where it's relatively safe. It also offers the fishermen an opportunity to fish in deep water in the channel from shore which is a relatively safe place. So consequently a very broad spectrum of people use the Paseo to fish and these people would include very young children up to very old people and even handicapped people, and I think that incorporated into the plans for the revetment the accessibility to the water or accessibility to the water and to the reef flat. By all, these people should be given high consideration. There are a number of suggestions that I suppose could be made but I won't make them now.

COL Thiede: Do you think we've not done that or do you have any specific information that you could expand upon in the three options that we've outlined in our report?

Mike Molina: Yes. It's not so much that area covered by the revetment. I believe that the rock revetment would be better than or preferable for the film and vegetation type.

COL Thiede: Why is that?

Mike Molina: Well, I just feel that it would not last. The vegetation types wouldn't last and it would be more expensive to perpetuate than a rock revetment, but at the same time it would not limit accessibility to the fishermen as much.

COL Thiede: Okay, that's what I wanted to ask you whether you thought that that's what this management relationship is all about.

Mike Molina: Although I think that a rock revetment is preferable from an erosion standpoint, I also and probably, I don't know about the Government or civilian if they have planned all of it now, a rock revetment would fit into that either. My concern would be that somehow the rock revetment would be modified so that this wide spectrum of people could still have the accessibility they have now to the water. It's a very popular place for hook and line fishing.

COL Thiede: You're talking about the rock revetment on the eastern side of the 500 foot standard feature of all the options?

Mike Molina: Yes. On the eastern side, that isn't so much, they're kind of different cases on both sides of the Paseo. On the western side just accessibility to the reef flat is probably the most important thing other than fishing from shore, but it's quite a departure for a lot of people when they use the reef flat in east Agana Bay to fish. They'll park out at Paseo, and they can get out to the outer reef flat which is relatively shallow and easy to walk without crossing the moat.

COL Thiede: That may be affected by the Governor's Agana Bay Development.

Mike Molina: Yes, right. Anyway, as it is now, it presents itself as a pretty valuable asset to the fishermen and on the otherside on the Western side of the Paseo it's more case of people fishing in deeper water right next to shore in relatively safe situation and something like a flat concrete walkway atop the revetment or on the otherside of the revetment or some sort of concrete ramp leading up to that area. With a seven foot high, I noticed the crest of the revetment will be seven foot high with the existing level of the Paseo now and that would also cut out all of the visibility of the boat harbor and everything else from the people standing on the Paseo which accommodates a lot of tourist too on a daily basis. I think part of the charm of the Paseo is being able to see the boat harbor, and a walkway atop the revetment or on the other side of the revetment with a safe passage to and from it would not only be an asset to the fishermen but to tourists and residents alike. It would just be a nice feature to be able to stroll along and look at the ocean and the city of Agana rather than be surrounded by rocks.

COL Thiede: It's a good point, we'll consider that. George, do you want to address him? George Young is the project engineer on this case.

George Young: Yes. In relationship to the aspect of visibility, crest elevation is seven feet so it's roughly angle height or at the height of ground so it won't be obstructing the view.

Mike Molina: Is it like from the top of the ceiling?

George Young: Yes.

Mike Molina: Oh, I see. That would make it more accessible to the people climbing over but I'm not sure from a safety factor that it would be preferable. Safety would be first of all to children and old people to get to the water to fish. Right now you can wheel a guy in a wheelchair right next to the water to fish but you couldn't do that if it was a rock revetment even if it was two feet high. That's about all I have to say.

COL Thiede: You can still do that on the otherside, on the west coast side.

Mike Molina: With Plan 2 you could also, if the revetment won't be placed as far back in along the channels. So I would think Plan 2 would be preferable to Plan 1 for that reason. That's why I don't think it's really necessary to have it all the way back. Thank you.

COL Thiede: Anything else, Mike?

Mike Molina: No, that's about it.

COL Thiede: Okay. The last scheduled speaker that we have is Pedro Terlane with the Department of Land Management but in this case he will be speaking as a private citizen rather than a representative of the department. Is that right, Pedro?

Pedro Terlane: Basically Colonel because I have not mentioned any of this to my superiors.

COL Thiede: Sure, so what would you like to say.

Pedro Terlane: Mr. Molina barely touched the safety aspects. I would favor the revetment but unlike the eastern shoreline there is a potential danger for accidental and frequent drowning on the westward shorelines. At that point, the toe of the revetment would be at a 12 foot depth of water. I was thinking perhaps that short of suggesting a fence, which would be totally out beyond the edge of the area, some kind of a modification would be made to the revetment, either to build it in further inland and thus provide a buffer between lets say elevation 1 foot or minus 1 foot horizontally to at the total of the revetment be creating some kind of a strip above the strip between the lowest portion of the revetment to lets say a foot of the water. I eat my lunch out there and I frequently see kids go near the water, not as much now because of the eroded condition, but- it would invite people to get closer to the water and heights in 2 or 3 feet probably would not be too much but here we're talking about 12 foot deep water with strong current perhaps repeated wave action from the boats going in and out of the harbor thus perhaps there is strong undertow so there's going to be repeated cases of people actually drowning, and I find that a significant concern of action.

COL Thiede: Are there many cases of drowning on the shoreline of Guam?

Pedro Terlane: Just last year there was one person.

COL Thiede: In the Paseo area?

Pedro Terlane: Yes, I was amazed because I didn't find any of that concern I've read in the report. The eastern shoreline, which is no problem at all, because we are talking only of 2 feet of water and there is not that much current action but unlike the western shoreline you got problems.

COL Thiede: Where did that drowning take place in the Paseo?

Pedro Terlane: It's beyond the bunker. Beyond the bunker by the Statue of Liberty side.

COL Thiede: I see.

Pedro Terlane: One guy I guess shot himself right near the same location.

COL Thiede: Shot himself? That's out of our jurisdiction.

Pedro Terlane: The design if anything, could be done, is to see whether it can be moved further inwards but it will be a buffer or is it possible to create a slight elevation at the toe of the revetment so that it will minimize the attempt by someone to climb over the small revetment and then try to get closer to the water. Right now its a uniform slope. I was hoping that there would be some kind of a barrier to prevent getting to and from, being that you wouldn't want to take a chance getting near the water.

COL Thiede: We've got certain conflicting wishes here. On one hand we got Mike saying let's get all the people close to the water as we can and you're saying let's make sure that they don't get to the water and fall in and drown. So we've got to balance those types of concerns.

Pedro Terlane: That's right. If people can throw their rod & reel from lets say off the elevated crest, that's perfectly fine but there's not a lot of people and especially the children just wanting to get closer to the water. There's no way we can keep an eye on this kind of things day in and day out. So through construction, I was hoping we might be able to come up with some way of denying these people that readily access onto the water.

COL Thiede: Did you understand Pete's concerns, George?

George Young: Yes, I did. I think it's possible to move the revetment back from where it's located now. One problem is in constructing it to avoid damaging the trees. The way we have it now is the best way. We'll take this into consideration.

COL Thiede: Did everybody hear what George said?

Pedro Terlane: I really don't want to see a fence built, but we have to have some kind of a protective barrier.

COL Thiede: As I indicated, Pete was the last scheduled speaker. Is there anyone else who has anything they'd like to say? For the benefit of the stenographer, speak up clearly and give your name and who you're representing.

Christie Anderson: Christie Anderson, Guam Environmental Protection Agency. I have two, actually three things. First of all, in the environmental assessment it states that there's a design variation which might be considered to actually help the fishermen but it might also do what you were asking and that's to construct a lip or shelf just above the knee high water mark so that they would actually ridge the revetment up right at the edge of the water, and that might keep people from going down into the water. So that would be a possible way of getting their concern and that's identifying the environmental assessment. I wanted to start my comments with a question and that was does the Army Corps have to choose the plan that has the highest benefit cost ratio?

COL Thiede: Generally, but not always, there's always a loophole in every regulation.

Christie Anderson: From the environmental standpoint, I have three serious reservations about this Plan 3. First of all and most importantly, the fact that the, and I'm talking only of the western side, the fact that the vegetation could be easily trampled and lost means that water quality could easily be degraded into focus through realm, and that's a major concern to the basin because traditionally we've had problems with water pollution primarily because it is basically close by the water. Secondly, it bothers me that it would actually reduce recreational access. The environmental assessment makes it clear that the lower angle of the slope to the vegetation would make it difficult for fishermen to cast into the water. They would actually have to cast farther than if it were a revetment. Thirdly, the maintenance cost for Plan 3 are four times the maintenance cost for Plan 2 and that's just astronomical and that's primarily to keep the vegetation going. So, from my standpoint, I would prefer to see Plan 2. Even though 3 has the benefit cost ratio it's still high it's still 2 but the 3 is the lowest.

COL Thiede: Well, those are all good points. I really appreciate those comments. Does anyone else have any questions, concerns or statements that they'd like to make based on what they've heard here this evening?

Dave Lotz: I just wanted to mention what two previous speakers were mentioning about access and safety. I think Pete has a good point that on your cross section of your breakwater, if you could consider putting a say a level area near the water line as part of the breakwater, it could serve as public access for handicapped people too and also act as a safety area.

Pedro Terlane: It is within the buffer, but I was looking for something that would be innovative and about the toe of the revetment to protect people from actually exercising their ability.

Dave Lotz: I was thinking of something that you could actually pave with.

COL Thiede: For people who wanted to get really close to the water, they still have the ability, but it's general to keep most of the public discouraged, most of the public, from getting down there. We might be able to do that. That doesn't look like that would be too difficult to accomplish or change the cost. Good. Anyone else have anything to say? One more time, we're generating a lot of good discussion here now, good thinking.

Pedro Terlane: Has the Corps dredged the potential part of the boat basin being used for commercial cargo loading and boat loading, because it's happening now.

COL Thiede: You mean as far as it affects the Paseo?

Pedro Terlane: Yes, the Plan and the revetment and all that.

COL Thiede: I don't know but it's a good point. What are the Governor of Guam's intentions for development of that small craft harbor? Originally, it was justified as a basin for approximately 300 recreational crafts and as Pete points out, it is being used to some degree for commercial activities and of course it hasn't even begun to reach its capacity as a small craft harbor.

Pedro Terlane: It's probably illegal but it's being done on both sides, from the boat basin side as well as from the Paseo side.

COL Thiede: You mean you're saying it's being loaded over the shores sort of speak? Over the beach?

Pedro Terlane: I really cannot see that kind of use to the Paseo. It's being done and I wonder whether I decide or they would be able to discourage that kind of activity all together from the Paseo side.

COL Thiede: To incorporate in our design some feature that will make it extremely difficult to use the shore protection for commercial activity.

COL Thiede: That's a good point. Anything else?

Audience: Colonel, how soon do you expect construction to get underway?

COL Thiede: Well, that's hard to say. We're just getting comments now on our detailed project report and environmental assessment and the next step of course is to zero in on one specific option and develop that, just a matter of developing that plan, making sure it's still viable and then sending it up to review and process for our Board of Engineers for River and Harbor, hopefully

then up to Congress and OMB. Of course, another significant potential project which may affect the Paseo project, which we just discussed with the Governor this afternoon was, his plans is front burner plans, is really top priority plans for development of Agana Harbor. I don't know how familiar you are with that or how much information has been put out and I don't really want to be the vehicle for explaining that plan if it hasn't come out officially yet from the Government of Guam, but close projected improvements on both sides of the Paseo area would dramatically affect this project.

Audience: How does the Corps of Engineers feel about the Governor's plan to bring in passenger liners into Agana Bay?

COL Thiede: Well, it's really not our job to evaluate that type of activity, but clearly if you can bring tourists in and bring enough of them to justify the cost in the considerable cost in building the harbor, well that's great.

Audience: So, from an Engineers standpoint it can be done but the big question in your mind is cost.

COL Thiede: Right. We haven't done any detailed analysis. We've seen some projections and we also have seen some cost figures but we haven't even begun to validate any of that. We may not even get involved in doing that if we haven't been really formally charged in getting involved. We both know it's in the development stage.

Audience: Should the plans finally be prepared it would be submitted to your office though, wouldn't it?

COL Thiede: Not necessarily. We could get involved in limited degree as technical advice up to full and completed volume over the next week or so.

Audience: Would it require Army Corps of Engineers' approval for the construction for the dredging?

COL Thiede: Well, under certain conditions. If it were totally funded by private sources of the Government of Guam decided to go on with the project on their own, it could generate the funds, it wouldn't need any federal involvement. It could be done without us actually doing the work. However, we absolutely would be involved in the environmental standpoint in authorizing the project in the first place. A project of that type would have to exceed approval through the regulatory program of the Corps of Engineers.

Audience: What were some of the costs you came across, projected costs?

COL Thiede: Well, I'd rather not say. I don't want to be the spokesman for laying out the whole program, but I'd rather have the information coming from representatives of the Government of Guam.

Audience: Okay. Sir, if it gets the approval of Congress and all these other agencies, you figure maybe a year or two years down the road?

COL Thiede: For which project?

Audience: For the Paseo, the one that this public meeting is all about.

COL Thiede: I'd say realistically a couple of years.

Audience: Okay. That's all I have, thank you sir.

COL Thiede: Does anyone else have anything? Okay, good. I'm not going to say anymore. I officially declare the meeting adjourned, but I'm delighted to have the opportunity to come to Guam again. It's been much too long. It's been about two years since I was here last. It's always a pleasant experience coming here. We obviously, tonight in this public meeting, opted for quality over quantity; very select group, very well informed group, a lot of good input. I appreciate your taking your valuable time to come out and participate in this meeting, and we hope we'll be actually able to develop this project much along the lines that you desire plus a number of other projects that are on the drawing boards for Guam. It looks like a very exciting time for the next couple of years for the water resources development business here, not only here but also throughout the Territories of the continent. Thanks again for coming.

#### IV. SUMMARY OF COMMENTS RECEIVED

U.S. Department of the Interior, Pacific Southwest Region (Aug 3, 1983).

##### Comment

The draft adequately describes existing fish and wildlife resources and marine environment and satisfactorily discusses the impacts of shoreline protection on these resources.

##### Response

Final EA has been modified to include recommendations of the Fish and Wildlife Service Coordination Act Report.

##### Comment

FWS draft Coordination Act Report of April 26, 1983 should be considered as the Final Coordination Act Report.

##### Response

Concur.

U.S. Department of the Interior, National Park Service, War in the Pacific National Historical Park, Guam (August 2, 1983).

##### Comment

Plans 1 and 2 are similar in permanence of construction but Plan 2 is more economically feasible particularly with the limited financial capability of the Government of Guam. Aesthetically, however, it will create a visual impact. The riprap of the Agana Marina parking lot area has enough visual effect in Agana, coupled with the massive riprap at the sewage treatment plant.

##### Response

Paragraph 3a(4), 3f(3), and 4c(2) adequately describe the visual setting and assess project impacts.

##### Comment

Aesthetically, Plan 3 appears to offer more of a serene and natural appearance than Plans 1 and 2, as likewise, more economically feasible. The local sponsor, the Department of Parks and Recreation, has administration and maintenance responsibility of the 30-acre Paseo de Susana Recreation area. Placement of several picnic units, shelters, and trash receptacles is anticipated and it will undoubtedly accommodate harmoniously a well-landscaped surrounding for enjoyment of our pole and net-cast fisherman and our island recreationers.

##### Response

See response above.

U.S. Department of the Interior, National Park Service, War in the Pacific  
National Historical Park, Guam (Continued)

Comment

Although Plan 3 has a lower degree of permanence than Plans 1 and 2, but if erosion remedial measures can be provided and achieved, then our recommendation is in order for adoption of Plan 3.

Response

The vegetative component of Plan 3 is located within the waters protected by the structures of the Agana Small Boat Harbor. Storms of the intensity to cause damage to the fill and vegetation will also cause erosion along the remainder of the unprotected shoreline in Agana Bay.

The construction contractor will be required to provide intensive maintenance of the vegetation after planting to insure the most rapid establishment.

U.S. Department of Commerce, National Oceanic & Atmospheric Administration,  
National Marine Fisheries Service, Southwest Region (August 2, 1983).

Comment

The proposed action described in the subject DEIS should not significantly affect resources for which NMFS has a responsibility. Our primary concern is the popularity of the site for recreational fishing during the seasonal runs of atulai (Carangids) and manahac (Siganids). Therefore, regardless of the alternative selected, construction should be scheduled between late November and early March to avoid conflicting with the fishing season. This schedule is particularly important for construction of the harbor (west) side shore protection at Paseo de Susana.

Response

As construction of the project is dependent upon authorization and funding by the Office of the Chief of Engineers, the construction scheduling cannot be made in advance of the fishing season. To minimize effects of the construction upon shoreside fishing, the contractor will be required to perform the work incrementally, fencing off the immediate job site, in order to leave the remainder of the shoreline open to fishing.

Comment

Every effort should be made to minimize turbidity and control erosion during the construction period.

Response

The Corps will require the construction contractor to maintain all the 1981 Territory of Guam Water Quality Standards.



PODED-PJ

DEPARTMENT OF THE ARMY  
U. S. ARMY ENGINEER DISTRICT HONOLULU  
FT SHAFTER, HAWAII 96858

8 April 1982



PAUL H. CALVO  
Governor

*Territory of Guam*

OFFICE OF THE GOVERNOR  
AGANA, GUAM 96910  
U.S.A.

APR 8 1982

I am pleased to inform you that we have initiated a detailed project study for possible shore protection measures at Paseo de Susana Park in Agana, Territory of Guam (see Incl 1). The study is being conducted under the authority of Section 103a of the River and Harbor Act of 1962, as amended.

The study will focus on the feasibility of shore protection measures and the extent of Federal participation. The first phase of the study will include the problems and needs issue, areas of particular concern, and possible alternative plans. As the study progresses, a full range of alternative solutions will be developed and evaluated. The final phase of the study will result in a detailed project report on possible improvements including an environmental statement.

We will be working closely with all interested Federal and Government of Guam agencies as well as the general public. We will continue to keep you informed of the study progress and welcome your comments or suggestions on any aspect of the study.

Sincerely,

KENNETH E. SPRAGUE  
Lt Col, Corps of Engineers  
District Engineer

1 Incl  
As stated

Lt. Colonel Kenneth E. Sprague  
District Engineer  
U.S. Army Corps of Engineers  
Building 230  
Ft. Shafter, HI 96858

Dear Lt. Colonel Sprague:

In regard to your letter, dated 8 April 1982, I have appointed the Bureau of Planning as the contact and coordinating agency for your proposed study "Possible Shore Protection Measures at Paseo de Susana Park in Agana, Territory of Guam."

The Bureau of Planning will serve as contact between yourself and other interested agencies.

If you require any further information from my office, please do not hesitate to contact me.

Sincerely yours,

PAUL H. CALVO



**DEPARTMENT OF THE ARMY**  
U.S. ARMY ENGINEER DISTRICT, HONOLULU  
FT SHAFTER, HAWAII 96859

PODED-PH

**PUBLIC WORKSHOP NOTICE**  
**PASEO DE SUSANA SHORE PROTECTION STUDY**

We will hold an informal public workshop to assist us in the study of the shoreline erosion problem at the Paseo De Susana Park on

Thursday, November 18, 1982  
at 7:00 PM  
in the Pacific News Building, Room 403

We wish to gather information useful to the study, including: (1) Community needs and desires for the park shoreline, (2) Storm conditions affecting the park and (3) Special environmental concerns for the park shoreline.

We look forward to seeing you at the workshop

*[Signature]* LTC, CE  
ALFRED J. THIEDE  
Colonel, Corps of Engineers  
District Engineer



**DEPARTMENT OF THE ARMY**  
U.S. ARMY ENGINEER DISTRICT, HONOLULU  
FT SHAFTER, HAWAII 96859

PODED-PH

**PUBLIC NOTICE**  
**PASEO DE SUSANA SHORE PROTECTION STUDY**

At the request of the Governor of Guam, the Honolulu District of the Corps of Engineers is conducting a feasibility study for the construction of shore protection measures for the Paseo de Susana Park in Agana. I invite all interested parties to attend the public meeting on the 7th of July 1983.

We will present and discuss alternative shore protection plans for the park. We seek your views on these plans and the various technical, economic, social and environmental issues associated with them. A Draft Detailed Project Report and Environmental Assessment containing descriptions of these plans will be available at the public meeting or at the Guam Operations Office, US Army Corps of Engineers, Pacific Daily News Building, Suite 905, Agana, Guam 96910.

As required by Executive Order 11988 and Section 404 of the Clean Water Act of 1977, we will consider and discuss comments on the possible impacts associated with the occupancy and modification of the floodplain and on the possible effects of the discharge of fill material on water quality during the construction.

There will be an opportunity for all interested persons to express their views and comments on the study. However, for accuracy of record, important facts or positions should be submitted in writing either at the public meeting or to the Honolulu District at the above address.

Please bring this announcement to the attention of other persons interested in these matters. I look forward to seeing you at this meeting.

*[Signature]*  
ALFRED J. THIEDE  
Colonel Corps of Engineers  
District Engineer



# United States Department of the Interior

NATIONAL PARK SERVICE  
PACIFIC AREA OFFICE  
300 Ala Moana Blvd., Box 50165  
Room 6305  
Honolulu, Hawaii 96850

ON REPLY REFER TO:

July 1, 1983

17619(PAAR)

Colonel Alfred J. Thiede  
District Engineer, Corps of Engineers  
Department of the Army  
U. S. Army Engineer District  
Ft. Shafter, Hawaii 96853

Dear Colonel Thiede:

We have no comments on the proposed Paseo de Susana Shore Protection Study.

Thank you for the opportunity to review the Proposal.

Sincerely,

Bryan Harry  
Director, Pacific Area



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL OCEAN SERVICE  
Washington D.C. 20230

N/MBZ:VLS

AUG - 3 1983

Col. Alfred Thiede  
U.S. Army Engineer District, Honolulu  
Building 230  
Fort Shafter, Hawaii 96858

Dear Colonel Thiede:

The Paseo de Susana Shore Protection, Territory of Guam, project report and environmental statement has been reviewed within the areas of the National Ocean Service's (NOS) responsibility and expertise, and in the terms of the impact of the proposed action on NOS activities and projects.

Geodetic control survey monuments may be located in the proposed project area. If there is any planned activity which will disturb or destroy these monuments, NOS requires not less than 90 days' notification in advance of such activity in order to plan for their relocation. NOS recommends that funding for this project include the cost of any relocation required for NOS monuments. For further information about these monuments, please contact Mr. John Spencer, Chief, National Geodetic Information Branch (N/CG17), or Mr. Charles Novak, Chief, Network Maintenance Section (N/CG162), at 6501 Executive Boulevard, Rockville, Maryland 20852.

Sincerely yours,

K. E. Taggart  
Rear Admiral, NOAA  
Acting Assistant Administrator





United States Department of the Interior

GEOLOGICAL SURVEY  
Water Resources Division  
P.O. Box 50166  
Honolulu, Hawaii 96850

August 1, 1983

Colonel Alfred J. Thiede, District Engineer  
Department of the Army  
U.S. Army Engineer District, Honolulu  
Ft. Shafter, Hawaii 96858

Dear Sir:

The Hawaii District Office of the U.S. Geological Survey, Water Resources Division has reviewed the Draft Detailed Project Report and Environmental Statement of the Paseo de Susana Shore Protection, Territory of Guam, and has no comments at this time.

Thank you for giving us the opportunity to review the report.

Sincerely,

*Don A. Davis*  
Don A. Davis  
Acting District Chief



UNITED STATES  
DEPARTMENT OF THE INTERIOR

OFFICE OF THE SECRETARY  
PACIFIC SOUTHWEST REGION  
BOX 38098 • 450 GOLDEN GATE AVENUE  
SAN FRANCISCO, CALIFORNIA 94102  
(415) 536-8200

ER 83/820

AUG 3 1983

Colonel Alfred J. Thiede  
District Engineer, Honolulu District  
U. S. Army Corps of Engineers  
Building 230  
Fort Shafter, Hawaii 96858

Dear Colonel Thiede:

The Department of the Interior has reviewed the draft environmental statement/Detailed Project Report, Paseo de Susana Shore Protection, Guam, and offer the following comments.

General Comments

The Fish and Wildlife Service (FWS) reports that the draft adequately describes the existing fish and wildlife resources and marine environment and satisfactorily discusses the impacts of shoreline protection on these resources.

Specific Comments

The FWS advises that their draft Fish and Wildlife Coordination Act Report, dated April 26, 1983, and included as Appendix C, should be considered the Final Coordination Act Report.

The Department appreciates this opportunity to comment.

Sincerely,

*Patricia Sanderson Port*  
Patricia Sanderson Port  
Regional Environmental Officer

cc: Director, OEPR (w/copy incoming)  
FWS/EC, W.A., D.C.  
Reg. Dir., FWS



# United States Department of the Interior

NATIONAL PARK SERVICE  
WAR IN THE PACIFIC  
NATIONAL HISTORICAL PARK  
MARINE DRIVE, AGANA  
P.O. BOX FA  
AGANA, GUAM 96910

IN REPLY REFER TO:

D3219(WAPA)

August 2, 1983

Alfred J. Thiede  
Colonel, Corps of Engineers  
U.S. Army Engineer District  
Fort Shafter  
Honolulu, Hawaii 96858

Dear Colonel Thiede:

We have reviewed the Draft of the Detailed Project Report and Environmental Statement and our comments are as follows:

1. Plans 1 and 2 are similar in permanence of construction but Plan 2 is more economically feasible particularly with the limited financial capability of the Government of Guam. Aesthetically, however, it will create a visual impact. The rip-rap of the Agana Marina parking lot area has enough visual effect in Agana, coupled with the massive rip-rap at the sewage treatment plant.
2. Aesthetically, Plan 3 appears to offer more of a serene and natural appearance than Plans 1 and 2, as likewise, more economically feasible. The local sponsor, the Department of Parks and Recreation, has administration and maintenance responsibility of the 30 acre Paseo De Susana Recreation area. Placement of several picnic units, shelters, and trash receptacles is anticipated and it will undoubtedly accommodate harmoniously a well landscaped surrounding for enjoyment of our pole and net-cast fisherman and our island recreationers.
3. Although Plan has a lower degree of permanence than Plans 1 and 2, but if erosion, remedial measures can be provided and achieved, then our recommendation is in order for adoption of Plan 3.

Thank you for the opportunity to comment.

Sincerely,

*Rafael J. M. Reyes*  
Rafael J. M. Reyes  
Superintendent

1447

|              |  |
|--------------|--|
| Mr. Tolson   |  |
| Mr. DeLoach  |  |
| Mr. Mohr     |  |
| Mr. Bishop   |  |
| Mr. Casper   |  |
| Mr. Callahan |  |
| Mr. Conrad   |  |
| Mr. Felt     |  |
| Mr. Gale     |  |
| Mr. Rosen    |  |
| Mr. Sullivan |  |
| Mr. Tavel    |  |
| Mr. Trotter  |  |
| Tele. Room   |  |
| Mr. Holmes   |  |
| Miss Gandy   |  |

*Thiede*



U.S. DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE  
Southwest Region  
Western Pacific Program Office  
P. O. Box 3830  
Honolulu, Hawaii 96812

August 2, 1983

F/SWR1:JJN

Colonel Alfred J. Thiede  
District Engineer  
U.S. Army Engineer Division  
Pacific Ocean  
Building 230  
Fort Shafter, HI 96858

Dear Colonel Thiede:

The National Marine Fisheries Service (NMFS) has received and reviewed the Draft Environmental Impact Statement (DEIS) and Draft Detailed Project Report for the Paseo de Susana Shore Protection Study, Agana, Guam. The following comments are offered for your consideration.

## General Comments

The proposed action described in the subject DEIS should not significantly affect resources for which NMFS has a responsibility. Our primary concern is the popularity of the site for recreational fishing during the seasonal runs of atuli (Carangids) and manahac (Siganids). Therefore, regardless of the alternative selected, construction should be scheduled between late November and early March to avoid conflicting with the fishing season. This schedule is particularly important for construction of the harbor (west) side shore protection at Paseo de Susana.

In addition to the above, every effort should be made to minimize turbidity and control erosion during the construction period.

Sincerely yours,

*John J. Naughton*  
John J. Naughton  
Acting Administrator

cc: F/SWR, Terminal Is., CA  
F/M4, Washington, D.C.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IX  
215 Fremont Street  
San Francisco, Ca. 94105

AUG 5 1983

Colonel Alfred J. Thiede, District Engineer  
U.S. Army Engineer District - Honolulu  
Building 230  
Fort Shafter, Hawaii 96858

ATTN: Mr. George Young

Dear Colonel Thiede:

The Environmental Protection Agency (EPA) has reviewed the Draft Detailed Project Report and Environmental Assessment (EA) titled PASEO DE SUSANA SHORE PROTECTION, CITY OF AGANA, TERRITORY OF GUAM. We have no comments to offer at this time.

We appreciate the opportunity to review this document. Please send us two copies of the final Environmental Assessment when available. If you have any questions, please contact me at (415) 974-8188 or FTS 454-8188.

Sincerely yours,

*Loretta Kahn Barsamian*  
Loretta Kahn Barsamian, Chief  
EIS Review Section



TERRITORY OF GUAM  
OFFICE OF THE GOVERNOR  
AGAÑA, GUAM 96910  
U.S.A.

RICARDO J. BORDALLO  
Governor

AUG 10 1963

Alfred J. Thiede  
Colonel, District Engineer (PODCOO)  
U.S. Army Corps of Engineers  
Building 230  
Ft. Shafter, Hawaii 96858

Dear Colonel Thiede:

Agencies of the Government of Guam have completed review of the draft "Paseo De Susana Shore Protection Study", and the following comments are offered as the Government of Guam's position.

While, for monetary reasons, the study selects option 3 as the preferred plan of action, it is the conclusion of the Government of Guam that option 2 would be more desirable for several reasons:

- 1) The annual maintenance cost for option 3 would seem, over time, to substantially negate the initial savings in implementing that option;
- 2) Due to the amount of storm activity that can be expected for Guam, erosion would continue to be a problem under option 3;
- 3) As is stated in the study, the popularity of this area for pole fishing, combined with the slope angle necessary for revegetation along the west shoreline, would contribute to the erosion process;
- 4) As is stated in the study, option 3 would make successful pole fishing along the west shoreline more difficult. Since pole fishing is recognized to be a popular recreation activity in this area, any impedence must be considered to be of major concern; and
- 5) As is stated in the study, option 3 could result in an increase in the rodent population, creating both a hazard and an increase in cost for eradication.

The Government of Guam prefers option 2 because of the above reasons and because that option offers the best opportunity for the continuation of the area's historical recreational use. There is, however, one suggestion which we feel should be considered in the planning, no matter which option is chosen. It is suggested that a flat platform area be included in the design of the revetment on the west shoreline in order to provide a safe area for shore fishermen, as well as for the handicapped.

Colonel Alfred J. Thiede  
Page 2

AUG 10 1963

I appreciate the effort that the Army Corps of Engineers has expended in this effort, and the close cooperation you have shown in trying to resolve the shore protection problem to the best advantage of Guam. I look forward to working with you in implementing this project.

Sincerely yours,

RICARDO J. BORDALLO

TERRITORY OF GUAM  
OFFICE OF THE GOVERNOR  
AGAÑA, GUAM 96910  
U.S.A.

Letter to Colonel Michael M. Jenks  
Page 2

RICARDO J. BORDALLO  
Governor

NOV 25 1983

Colonel Michael M. Jenks  
U.S. Army Engineer District, Honolulu  
Fort Shafter, Hawaii 96858

Dear Colonel Jenks:

I am responding to your letter of October 21, 1983.

The Government of Guam hereby endorses Plan 3 of the Paseo de Susana Shore Protection Project under Section 103a of the River and Harbor Act of 1962, as amended. The Government of Guam also declares its intention to:

- a. Provide without cost to the United States all necessary lands, easements, rights-of-way, and other real estate interests, as well as any relocations, disposal areas, and drainage improvements required for construction of the project;
- b. Hold and save the United States free from damages which may result from construction, operation and subsequent maintenance of the project, except damages due to the fault or negligence of the United States or its contractors;
- c. Assure continued conditions of public ownership and use of the shore upon which the amount of Federal participation is based during the economic life of the Project;
- d. Maintain and operate the improvements after completion in accordance with regulations to be prescribed by the Secretary of the Army;
- e. Provide and maintain necessary access roads, open and available to all on equal terms;
- f. Comply with the provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646);
- g. Comply with Title VI of the Civil Rights Act of 1964 (Public Law 88-352); and

- h. Subject to the Federal limitation of \$1,000,000, provide a cash contribution, prior to the initiation of construction, equivalent to 30 percent of the total construction costs of the project.

I understand that this letter expresses the intent of the Government of Guam and does not legally bind us to the above agreement. Furthermore, I reserve the right to alter or withdraw this endorsement dependent on the final Agana Bay Development Plan. I also understand that this agreement must be formally executed in accordance with Section 221 of the River and Harbor Act of 1970, prior to commencement of construction of the project.

Sincerely yours,

RICARDO J. BORDALLO



DEPARTMENT OF PARKS AND RECREATION  
GOVERNMENT OF GUAM  
AGANA, GUAM 96910

NOV 21 1983

Mr. David Sox  
U.S. Army Corp of Engineers  
Planning Branch (POED-PV)  
Building T-1  
Fort Shafter, Hawaii 96855

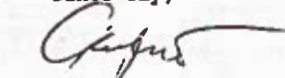
Dear Mr. Sox:

I have received copies of the draft project report and environmental assessment for the Paseo de Susana shore protection project. The Japanese Pillbox (66-01-1082) is currently on the Guam Register of Historic Places but not on the National Register. It may be eligible to the National Register as part of a thematic nomination of World War II coastal defenses and fortifications.

The shore protection plans as presented should have no effect on any significant cultural resources. The western revetments are carefully drawn to miss the pillbox. The eastern revetments do not appear to reach the pre-World War II shoreline, so there is no concern about the possibility of archaeological remains along the original shoreline as far as this construction is involved.

As the Guam Historic Preservation Officer, I concur with your assessment that the pillbox should be preserved (page EA-3) and that the project as described should have no effect on it (page EA-7).

Sincerely,

  
JOE E. PAULINO  
State Historic Preservation  
Officer

## VI. MAILING LIST

### PASEO DE SUSANA SHORE PROTECTION AGANA, TERRITORY OF GUAM

#### TERRITORY OF GUAM

Honorable Ricardo J. Bordallo  
Governor of Guam  
Agana, Guam 96910

Honorable Edward D. Reyes  
Lieutenant Governor of Guam  
Agana, Guam 96910

Aquatic and Wildlife Resources Division  
Department of Agriculture  
Government of Guam  
Agana, Guam 96910

Director  
Department of Commerce  
Government of Guam  
Agana, Guam 96910

Director  
Department of Public Health &  
Social Services  
Government of Guam  
Agana, Guam 96910

Territorial Planning Commission  
Government of Guam  
Agana, Guam 96910

Director  
Department of Labor  
Government of Guam  
Agana, Guam 96910

Director  
Department of Land Management  
Government of Guam  
Agana, Guam 96910

Director  
Guam Environmental Protection Agency  
P. O. Box 2999  
Agana, Guam 96910

Director  
Department of Public Safety  
Government of Guam  
Agana, Guam 96910

Administrator  
Guam Economic Development Authority  
Government of Guam  
P. O. Box 3280  
Agana, Guam 96910

Chief Officer  
Public Utility Agency of Guam  
Government of Guam  
Agana, Guam 96910

Director  
Marine Laboratory  
University of Guam  
P. O. Box EK  
Agana, Guam 96910

Director  
Department of Agriculture  
Government of Guam  
Agana, Guam 96910

Director of Federal Programs  
Bureau of Planning, Budget &  
Management  
Office of the Governor  
Agana, Guam 96910

Director of Tourism  
Government of Guam  
Agana, Guam 96910

Director  
Department of Parks & Recreation  
P. O. Box 2950  
Agana, Guam 96910

## VI. MAILING LIST

### TERRITORY OF GUAM (Cont)

Director  
Bureau of Planning  
Government of Guam  
Agana, Guam 96910

Historic Preservation Officer  
Department of Parks & Recreation  
Government of Guam  
Agana, Guam 96910

Director  
Department of Public Works  
Government of Guam  
P. O. Box 2950  
Agana, Guam 96910

Honorable Antonio B. Won Pat  
Representative in Congress  
P. O. Box 3549  
Agana, Guam 96910

Honorable Antonio B. Won Pat  
U.S. House of Representative  
2441 Rayburn House Office Bldg.  
Washington, DC 20515

Chief  
Planning & Research Bureau  
Guam Legislature  
Agana, Guam 96910

Senator Edward T. Charfauros  
Guam Legislature  
P. O. Box 373  
Agana, Guam 96910

Senator Thomas C. Crisostomo  
Guam Legislature  
P. O. Box 373  
Agana, Guam 96910

Manager  
Port Authority of Guam  
Government of Guam  
P. O. Box 1445  
Agana, Guam 96910

Senator Benigno M. Paloma  
Guam Legislature  
P. O. Box 373  
Agana, Guam 96910

Senator John F. Quan  
Guam Legislature  
P. O. Box 373  
Agana, Guam 96910

Senator Antonio R. Unpingco  
Guam Legislature  
P. O. Box 373  
Agana, Guam 96910

Agana Village Commissioner  
P. O. Box 786  
Agana, Guam 96910

Chief Commissioner  
P. O. Box 786  
Agana, Guam 96910

Agana Heights Village Commissioner  
P. O. Box 786  
Agana, Guam 96910

Bureau of Planning  
Guam Coastal Zone Management Office  
Government of Guam  
Agana, Guam 96910

Tamuning Village Commissioner  
P. O. Box 786  
Agana, Guam 96910

## VI. MAILING LIST

FEDERAL (Numbers in parenthesis indicate number of copies forwarded)

Office of Federal Activities, A-104  
Environmental Protection Agency  
Room 537 West Tower, Waterside Mall  
401 M Street, S.W.  
Washington, DC 20460  
ATTN: EIS Filing Section (5)

EIS Coordinator  
U.S. Environmental Protection Agency  
Region IX (0-3)  
215 Fremont St  
San Francisco, CA 94105 (5)

Administrator  
Federal Highway Administration  
300 Ala Moana Blvd, Rm 4119  
Honolulu, HI 96850 (1)

Administrator, Southwest Region  
National Marine Fisheries Service  
US Department of Commerce  
P. O. Box 3830  
Honolulu, HI 96813 (1)

Deputy Assistant Secretary for  
Environmental Affairs  
US Department of Commerce  
Washington, DC 20230 (2)

Secretarial Representative, Region IX  
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PASEO DE SUSANA SHORE PROTECTION  
TERRITORY OF GUAM

FISH AND WILDLIFE COORDINATION



PODED-PV

DEPARTMENT OF THE ARMY  
U. S. ARMY ENGINEER DISTRICT, HONOLULU  
FT SHAFTER, HAWAII 96858

9 April 1982

Regional Director, SW Region  
US National Marine Fisheries Service, NOAA  
300 South Ferry Street  
Terminal Island, CA 90731

Dear Sir:

Pursuant to the 1978 Amendments of the Endangered Species Act of 1973, we are requesting information on any listed or proposed endangered or threatened species within your jurisdiction that may be present in the Paseo de Susana project area, Agana, Guam (Incl 1). The US Army Corps of Engineers has already initiated fish and wildlife coordination with the US Fish and Wildlife Service, Division of Ecological Services (Honolulu). We will appreciate any additional information provided by your Service. If you have any questions, please contact Mr. Arthur G. Cropper of my staff at (808) 438-2264.

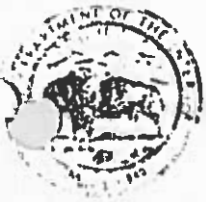
Sincerely,

1 Incl  
As stated

KISUK CHEUNG  
Chief, Engineering Division

CF: w/o incl  
Mr. Richard S. Shomura  
US National Marine Fisheries Service, NOAA  
2570 Dole Street  
Honolulu, HI 96822





# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

100 ALA MOANA BOULEVARD

P.O. BOX 57167

HONOLULU, HAWAII 96858

6  
d/4  
6/1  
ES  
Room 6307  
1-2-80-S.D.-21

APR 14 1982

Mr. Risak Cheung  
Chief, Engineering Division  
U.S. Army Engineer District, Honolulu  
Ft. Shafter, Hawaii 96858

Dear Mr. Cheung:

This replies to your request of April 9, 1982 for information on endangered or threatened species, listed or proposed, which may be present in the proposed Paseo de Susana project area, Agaña, Guam.

To the best of our knowledge, there are no endangered or threatened species, listed, proposed, or candidate for listing present in the proposed project area.

Thank you for sharing our concern for conserving listed species.

Sincerely yours,

*[Signature]*  
Pacific Islands Administrator



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**U.S. DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
NATIONAL MARINE FISHERIES SERVICE  
Southwest Region  
Western Pacific Program Office  
P. O. Box 3830  
Honolulu, Hawaii 96812

April 21, 1982

F/SWR1:ETN

Mr. Kisuk Cheung  
Chief, Engineering Division  
U.S. Army Corps of Engineers  
Fort Shafter, Hawaii 96858

Dear Mr. Cheung:

Your April 9, 1982 request for information regarding threatened and endangered species that may be present in the Paseo de Susana project area, Agana, Guam has been forwarded to this office for reply.

To our knowledge there are no resident threatened or endangered species under National Marine Fisheries Service jurisdiction found in the immediate project area. Although green turtles (Chelonia mydas), which are listed as threatened, may be occasionally sighted in the vicinity we have no confirmed reports of such activity, and do not expect any impacts to this species from the proposed project.

For further information you may wish to refer to our February 19, 1982 letter to you regarding the Apra Harbor Study Area.

Sincerely yours,

Doyle E. Gates  
Administrator

Enclosure

cc: A. Ford, F/SWR w/o encl.



# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

300 ALA IKAIA BOULEVARD  
P O BOX 50167  
HONOLULU HAWAII 96833

IN REPLY REFER TO:

ES  
Room 6307  
MAY 23 1983

Colonel Alfred Thiede  
U.S. Army Engineer District, Honolulu  
Bldg. 230  
Ft. Shafter, Hawaii 96858

Dear Colonel Thiede:

In compliance with the Fish and Wildlife Coordination Act, the Aquatic and Wildlife Resources Office, Territory of Guam, has provided detailed review comments of our Draft Coordination Act Report for your Paseo De Susana Shore Protection Study. The additional information concerning fishery resources which has been provided in their correspondence (Attachment) will be incorporated into the Service's Final Coordination Act Report.

The Paseo De Susana park is perhaps the most popular recreational fishing area for people of all ages on Guam. I strongly support the recommendations of Aquatic and Wildlife Resources concerning enhancement of recreational fishing opportunities at the Paseo. The Service requests that your planning staff include these recommendations in their detailed project planning for shore protection. Please contact me immediately if you are unable to consider these enhancement measures.

Sincerely,

*Dale T. Coggeshall*  
for Dale T. Coggeshall

Pacific Islands Administrator

cc: GAWR  
NMFS-WPPO  
RD, FWS, Portland, OR (AHP)



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T. 116  
C. 85

Administrative Services  
Agriculture and Fisheries Services  
Animal and Plant Industries  
Aquatic and Wildlife Resources  
Forestry and Soil Resources  
Animal Quarantine Services

AGANA BAY PROTECTION STUDY

DATE 7/4-89 11/2/3

May 13, 1983

Dale Coggeshall  
Pacific Islands Administrator  
U.S. Fish and Wildlife Service  
P.O. Box 50167  
Honolulu, Hawaii 96850

Dear Dale:

We have reviewed the proposed action outlined in the Draft Coordination Act Report, Paseo de Susana Shore Protection Study, and have the following comments:

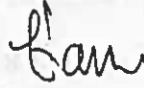
1. Table 1 underestimates the species composition of desirable food fishes found on the reef flat in Agana Bay. Our creel census data have shown that many species including several acanthurids, carangids, labrids, lethrinids, lutjanids, mugilids and mullids, among others, are commonly caught on the reef flat by net, spear, and hook and line fishermen. Many of these fishes are also caught in the channel by hook and line fishermen. In addition to seasonally intense fishing for atulai (Selar cumenophthalmus) and mahahac (juvenile Siganus spinus and S. argenteus) fishing for ee (juvenile Caranx melampygus, C. ignobilis and C. sexfasciatus) along both sides of the Paseo is also very popular.
2. In its present condition, the Paseo offers centrally - located easy access to deeper - water angling from shore (in the boat basin channel) and shallow - water fishing of various types on the outer moat and reef flat (in East Agana Bay). Many people of all ages currently use the Paseo either as a fishing spot or as a point of departure for fishing on the nearby reef. The spectrum composed by these people is broad and includes very young children, the elderly and the physically handicapped.

We feel that the fishing opportunities presented at the Paseo should be enhanced for all people, and this should be considered in the design of the proposed action. Shore protection is necessary, but safety and accessibility are also important. Some suggestions in this regard include the incorporation of a solid concrete ramp(s) leading to a solid concrete cap(s) atop or on the ocean side of revetment so that the very young, elderly and physically handicapped may continue to safely fish these nearshore waters. A ramp/walkway atop or along the ocean side of revetments are not absolutely necessary but would provide access to fishermen

as well as provide strollers and tourists with better views of the ocean, boat harbor and coastline, which will be impaired at ground level by an 8 - 10' high structure. A ramp or stairway leading down to the water's edge would allow easier access to the reef flat on the eastern side of the Paseo.

Finally, we agree with all three of the Service's recommendations for mitigation and are thankful for the opportunity to comment.

Sincerely,



HARRY T. KAMI  
Chief

Aquatic & Wildlife Resources





# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

300 ALA MOANA BOULEVARD  
P. O. BOX 50167  
HONOLULU, HAWAII 96350

CDR  
DEP my  
ADZ ET-3  
IN REPLY REFER TO:  
SEA  
ES  
Room 6307 E. L. M.  
APR 26 1983 2 6

Colonel Alfred J. Thiede  
U.S. Army Engineer District, Honolulu  
Building 230  
Fort Shafter, Hawaii 96858

Re: Coordination Act Report  
Paseo De Susana Shore  
Protection Study

Dear Colonel Thiede:

This is the Service's Draft Coordination Act Report regarding the Honolulu District's plans to construct shore protection at Paseo De Susana, Guam. This report has been prepared under the authority of and in accordance with the provisions of Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661, et seq.) and other authorities mandating Department of Interior concern for habitat resources. It is also consistent with the intent of the National Environmental Policy Act. Our comments herein are preliminary and subject to revision. Additional Service comments and recommendations will be provided in a Final Coordination Act Report.

This report is based upon available data and scientific literature, and the observations made during a brief, joint-agency field survey conducted by John Ford and Maridell Foster in July 1982. This letter was prepared by John Ford.

### DESCRIPTION OF THE PLANNING AREA

The Paseo De Susana peninsula forms the southwestern boundary of Agana Bay, Guam (Figure 1). It is situated immediately east of the Agana Boat Basin and the Agana Sewage Treatment Plant (Figure 2). Most of the peninsula seaward of Marine Drive has been dedicated to public park use; however, a public market and fishermen's coop, a stadium and carnival grounds are also situated in this area.

Paseo De Susana park is entirely filled land. The shoreline consists mostly of scattered and crumbling rip-rap, dead coral boulders and rubble, and coarse sand along the east and west sides (Figures 3 - 5 in our Planning Aid letter of September 9, 1982). Banks are undercut in several locations. The seaward tip of the peninsula consists of concrete and rip-rap. A stub breakwater extends from the northwestern tip of the peninsula and protects the entrance to Agana boat channel. The eastern shore



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is strewn with rusting debris from old vehicles. Flotsam and trash were observed around the entire project area.

The Agana River mouth is located on the east side of the peninsula. Before the park area was filled, the river mouth and a section along the Agana boat basin were part of the same drainage system. A dredged boat channel runs along the entire west side of the peninsula, and a shallower channel may be found extending seaward from the mouth of the Agana River to the east of the peninsula. A detailed description of the submarine geology at and near the project site appears in Reference 3.

#### DESCRIPTION OF THE PROPOSED ACTION

The Honolulu District is considering three plans of improvement for shore protection at Paseo De Susana. Each of the three alternatives involve the construction of a 590' long by 10' high, sloping revetment from the tip of the peninsula down its eastern edge. The revetment would consist of ungrouted armor stone, and would have a top width of 8'.

Plan 1 involves construction of a 940' long by 8' high revetment along the western (harbor) side of the peninsula. The components of Plan 2 are essentially the same as Plan 1; however, the revetment length is reduced to 500'. Plan 3 involves landscaping the western shoreline and planting beach morning glory along the graded slope. Armor stone revetments would have a 1:1.5 slope, and the grassed slope would be 1:3. A preferred plan has not been selected at this time.

#### FISH AND WILDLIFE RESOURCES

##### Without the Project

Vegetation along the shore above the beach consists of scattered ironwood (Casuarina equisetifolia), nanaso (Scaevola taccada), alahai tasi (Ipomoea pes-caprae), hunek (Messerschmidia argentea), coconut palm (Cocos nucifera), binalo (Thespesia populnea), beggar's tick (Bidens pilosa), Wedelia sp., and several species of grasses.

Nearshore waters were turbid during the field reconnaissance. All marine waters surrounding the project area are classified as Class M-2 by the Guam Environmental Protection Agency. Uses attributed to this category of waters are intended to protect the propagation and survival of a balanced and indigenous population of marine organisms, particularly coral reefs and shellfish. Mariculture, aesthetic enjoyment and compatible recreation are also uses identified for this class of coastal waters. According to current Guam Water Quality Standards, concentrations of suspended matter (at any point) shall not be increased more than 10% from ambient at any time, and should not exceed 80 mg/l except when due to natural conditions (such as experienced during our field survey.)

Descriptions of intertidal and nearshore marine habitat may be found in References 1, 2, and 4. Benthic habitat along the edges of the project area adjacent to the two channels consists principally of dead coral rubble and concrete blocks. A substantial amount of silt exists on the surface of the rubble and within interstices. Bits of Sargassum sp. lay washed up along the shore in this area. Invertebrate animals observed during our field reconnaissance include sea cucumbers (Holothuria), small limpets and strombs, Trochus sp. shells, hermit and grapsid crabs. Juvenile fishes observed represented the pipefishes (Sygnathidae), blennies (Bleniidae), surgeonfishes (Acanthuridae), gobies (Gobiidae), rabbitfishes (Siganidae), and damselfishes (Pomacentridae). Generally, our observations revealed a greater diversity of organisms along the western (harbor) side of the Paseo De Susana peninsula.

A depressed reef flat consisting of a narrow reef-rock pavement exists between the outer tip of the peninsula and a slightly elevated inner reef margin zone (Figure 3, Reference 2). This area is dominated by strong longshore currents which sweep toward Agana channel. Corals are mostly absent from this area except for widely scattered patches of Porites lutea. An inner reef margin lies seaward of the reef flat. An algal mat, consisting primarily of Amphiroa, Sargassum and Caulerpa, dominates this habitat. Porites lutea is the only species of coral which has been reported from this area.

To the west of the stub breakwater lies a rubble platform which slopes downward to the face of the boat channel slope. Reference 2 reports that corals are inconspicuous in this area, with the exception of a few patches of Millepora dichotoma and Porites lutea. Larger boulders and blocks show small colonies of encrusting Montipora sp. and Pocillopora sp. The face of the boat channel slope is composed of rubble, gravel, and sand interspersed with rocky outcroppings and coral knobs. Millepora dichotoma, Porites lutea, and Pocillopora damicornis may be found in this habitat.

Reference 4 lists algae and corals found along a short transect to the west of the Agana Sewage Treatment Plant island. Table 1 lists fishes observed along a reef flat transect in central Agana Bay in 1977 and 1978 (Reference 1). This information may be of value for comparative purposes.

No fishing or fishermen were observed during our field survey. However, recreational fishing occurs year round in the park. Seasonally intensive fishing occurs along the western (harbor) side of the peninsula for "atulai" (Selar crumenophthalmus). Atulai runs generally occur during the period from August through November. Hook and line fishing is permitted with no take limits. Net fishing for atulai in the Agana Boat basin is limited to the hours of 3 a.m. to 7 a.m. Each year during the peak atulai runs, conflicts arise between net and pole fishermen in the boat basin as the net fishermen may capture the fish schools before the reach the shore. Net fishermen may also

Table 1. Estimated Abundance of fishes (no. per m<sup>2</sup>) in reef flat zones on Agana Bay, April 1977 and March 1978. A=Inner Reef Flat--Sand Subzone; B=Inner Reef Flat--Scattered Coral Subzone. (Adapted from Amesbury 1978).

| FAMILY NAME<br><u>Genus Species</u> | A<br>(0-220m) | B<br>(220-310m) |
|-------------------------------------|---------------|-----------------|
| ACANTHURIDAE                        |               |                 |
| <u>Naso</u> sp. (juvenile)          | .01           |                 |
| APOGONIDAE                          |               |                 |
| <u>Apogon novemfasciatus</u>        | .01           | .01             |
| ATHERINIDAE                         |               |                 |
| unidentified atherinids             | .01           |                 |
| BALISTIDAE                          |               |                 |
| <u>Pseudobalistes</u>               |               | .01             |
| BLENNIIDAE                          |               |                 |
| unidentified blennids               | .01           | .01             |
| BOTHIDAE                            |               |                 |
| <u>Bothus</u>                       | .01           |                 |
| CANTHIGASTERIDAE                    |               |                 |
| <u>Canthigaster solandri</u>        | .06           | .01             |
| CHAETODONTIDAE                      |               |                 |
| <u>Chaetodon auriga</u>             |               | .01             |
| <u>C. trifascialis</u>              |               | .01             |
| <u>C. trifasciatus</u>              |               | .01             |
| GOBIIDAE                            |               |                 |
| unidentified gobiids                | .02           | .01             |
| HOLOCENTRIDAE                       |               |                 |
| <u>Flammeo</u> sp.                  |               | .04             |
| LABRIDAE                            |               |                 |
| <u>Halichoeres marginatus</u>       |               |                 |
| <u>H. trimaculatus</u>              | .01           | .13             |
| <u>Stethojulis bandanensis</u>      | .01           | .01             |
| juvenile labrids                    | .01           | .01             |
| MULLIDAE                            |               |                 |
| <u>Parupeneus barberinus</u>        | .01           | .01             |

Table 1. (Continued)

|                                     |     |     |
|-------------------------------------|-----|-----|
| POMACENTRIDAE                       |     |     |
| <u>Dascyllus aruanus</u>            | .06 |     |
| <u>Eupomacentrus albifasciatus</u>  |     | .31 |
| <u>E. lividus</u>                   | .01 | .07 |
| <u>E. nigricans</u>                 |     | .01 |
| <u>Plectroglyphidodon leucozona</u> | .01 |     |
| juvenile pomacentrids               | .01 | .01 |
| SIGANIDAE                           |     |     |
| <u>Siganus spinus</u>               | .08 | .05 |
| SYNGNATHIDAE                        |     |     |
| unidentified syngnathids            | .01 |     |

---

|                                            |     |     |
|--------------------------------------------|-----|-----|
| Total No. Species                          | 17  | 18  |
| Total Fish Abundance (no./m <sup>2</sup> ) | .35 | .73 |

obstruct the entrance channel while surrounding schools of atulai. Reported annual harvest of atulai on Guam (total island-wide catch) may be as high as 20,000 kg. Runs of "manahac", juvenile rabbitfish (Siganus spp.) also occur across the shallow reef flats at Paseo De Susana in the spring.

There are no listed endangered or threatened species of animals or plants known to inhabit or frequent the project area.

#### With the Project

No significant long-term impacts to the marine or terrestrial environments are anticipated as a result of implementing Plans 1 or 2 at Paseo De Susana. Adverse effects to water quality and adjacent benthic habitat will probably be limited to the construction phase of project implementation. Plan 3 may result in long-term degradation of water quality due to gradual erosion of the grassed slope by wave action and continuous foot traffic.

During construction of any alternative, grading and cutting the existing shore and placement of fill material will generate plumes of turbid water due to introduction of suspended fine sediments. If these plumes are not contained to the immediate project area, they may stress corals in adjacent areas. Placement of stone rip-rap along the shoreline will bury some sub- and intertidal habitat. However, the resulting surfaces will be suitable for colonization by algae and invertebrates. Impacts of alterations in normal water circulation patterns around the peninsula on fish and wildlife resources by the proposed project are expected to be slight.

Construction will temporarily inhibit access along the shoreline for recreational fishing. However, no long-term changes in fishing success are anticipated as a result of project implementation.

#### RECOMMENDATIONS

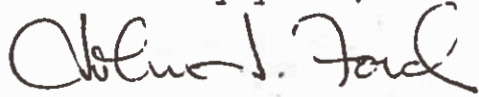
The Service suggests that the Corps incorporate the following measures to mitigate construction-related impacts and enhance recreational use of the park project design:

- 1) Efforts should be taken to confine suspended sediments to the immediate project area during construction. Dredged, cut or graded material should be protected from erosion, and only clean water should be allowed to run off into the harbor and bay.

- 2) If practicable, construction of the western (harbor) side improvements should begin at the close of the annual atulai season (December), and should be completed as soon as possible. Safe shoreline access should be provided for fishermen at Paseo De Susana to the maximum extent possible during construction.

3) The project area should be revegetated with indigenous strand and shade plants and trees to enhance the aesthetic value of the park.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "John I. Ford". The signature is fluid and cursive, with the first name "John" being more prominent and the last name "Ford" following in a similar style.

John I. Ford  
Acting Project Leader  
Office of Environmental Services

Enclosure: Bibliography

cc: NMFS-WPPO  
GAWR  
RD, FWS, Portland, OR (AE)

## BIBLIOGRAPHY

1. Amesbury, S. S. 1978. Studies on the biology of the reef fishes of Guam. Part I: Distribution of fishes on the reef flats of Guam. University of Guam Marine Laboratory Tech. Rept. No. 49.
2. Randall, R. H. and L. G. Eldredge. 1976. Report on the coral survey of the Agana Bay reef flat. Rept. for US Army Engineer Division, Pacific Ocean, Contract No. DACW84-76-M-0283.
3. Randall, R. H. and J. Holloman. 1974. Coastal survey of Guam. University of Guam Marine Laboratory Tech. Rept. No. 14.
4. Rowley, D. M. 1981. First annual report on the marine benthic algae and coral communities at nine biological stations around Guam. Guam Environmental Protection Agency.

**PASEO DE SUSANA SHORE PROTECTION  
TERRITORY OF GUAM**

**ENGINEERING INVESTIGATIONS  
AND  
DESIGN ANALYSIS**

APPENDIX D  
ENGINEERING INVESTIGATIONS AND DESIGN ANALYSIS

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## APPENDIX D

### SECTION 1. DESIGN ANALYSIS

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## I. DESIGN ANALYSIS

### GENERAL

A shore protection design analysis requires the determination of the following elements:

a. Function and Limitations

- (1) Structure Use and Shape
- (2) Structure Location and Dimensions
- (3) Characteristics of Adjacent Land

b. Weather and Hydraulic Conditions

- (1) Wind
- (2) Waves
- (3) Tides

### EROSION PROCESSES

The reef fringing Agana Bay provides protection from wind-generated waves to the Paseo de Susana Park shoreline throughout the year except during periods of high storm water elevations. Site visits to the park in April, August, and November 1982, all during fair weather periods, indicated no direct wave attack upon the park shoreline during these periods. These site inspections essentially confirmed assessments made of the Paseo shoreline in the Guam Comprehensive Study Shoreline Inventory completed by the Honolulu District in September 1980. Erosion reaches are shown in Figure D-1.

Reach 1 extends for 1,000 feet along the east park shoreline seaward from the mouth of the Agana River and appears generally stable. A 2- to 3-foot high scarp is present in the seaward 500 feet of the reach, but is vegetated, indicating that erosion is not chronic.

Reach 2 extends for 240 feet from the seaward end of Reach 1 to the eastern end of the existing rubble revetment along the park tip. Chronic erosion is occurring throughout this reach, ranging from intermediate at the south end to severe at the north end.

Reach 3 consists of 400 feet of the existing limestone revetment along the tip of the park. Critical erosion is occurring in the east 50 feet of the revetment adjacent to Reach 2. Thirty feet of the revetment has failed due to piping of the material behind the armor stones.

Reach 4 consists of 600 feet of limestone boulder revetment protected by the Agana Harbor east breakwater at the extreme northern tip of the park. The inner 250 feet of this revetted reach are protected by the Agana Harbor wave absorber. This reach is generally stable and protected by the Agana Harbor structures.

Reach 5 consists of 970 feet of shoreline between the south end of the existing Corps wave absorber and the Agana Boat Basin. Intermediate to critical erosion is occurring throughout this reach, as evidenced by a 2- to 3-foot wave cut scarp in the backshore.

The most severe erosion is centered in the 590 feet of the reach adjacent to the wave absorber.

#### PROBLEM ANALYSIS

The most critical need for shore protection, based on the previous section, occurs at the northeastern tip of the park, and along the entire unprotected west side of the park. The susceptibility of the park tip to erosion is primarily due to its being within 300 feet of the Agana Bay reef margin and its resultant greater exposure to storm waves. The susceptibility of the west shoreline to wave attack is primarily due to its exposure to waves traveling up the Agana Harbor entrance channel.

For these two areas of most critical erosion, the direction of wave attack is not perpendicular to the shoreline, but rather at a slight angle nearly parallel to the shore. Placement of an energy-absorbing shoreline structure at the seaward end of park shoreline would serve to dampen a portion of the wave energy that might otherwise travel farther inland.

Based on this information, the most suitable method for protecting the eastern shoreline appears to be 500 feet of revetment which would overlap both the failure area in Reach 3 and the critically eroding area in Reach 2. The entire 970 feet of the west shoreline requires stabilization, however, placement of a revetment in the more critical 590 feet adjacent to the existing wave absorber could similarly reduce wave energy passing farther inside the Agana Boat Basin.

#### WATER LEVELS

a. TIDES. The nearest tidal benchmark to the study site is at Apra Harbor. Tidal data for the 19-year period between 1949-1967 is as follows:

|                         | <u>Feet</u> |
|-------------------------|-------------|
| Highest tide (observed) | 3.3         |
| Mean higher high water  | 2.4         |
| Mean high water         | 2.3         |
| Mean tide level         | 1.45        |
| Mean sea level          | 1.4         |
| Mean low water          | 0.6         |
| Mean lower low water    | 0.00        |
| Lowest tide (observed)  | -1.9        |

All elevations are referenced to mean lower low water (MLLW).

b. ASTRONOMICAL TIDE ( $S_a$ ).

The astronomical tide is estimated to be equivalent to the mean higher high water of 2.4 feet.

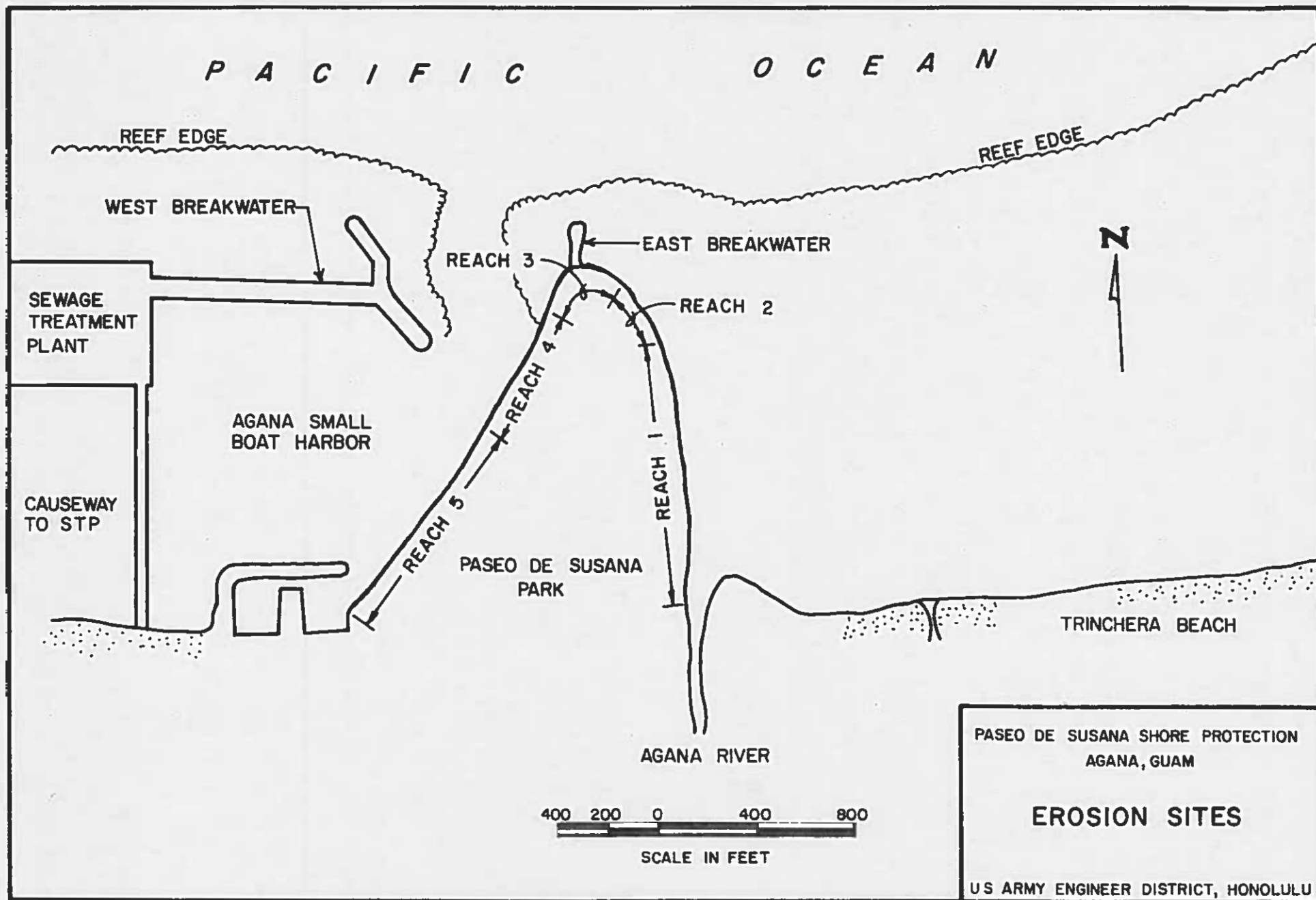


FIGURE D-1

c. ATMOSPHERIC PRESSURE DROP ( $S_p$ ).

The water level rise due to atmospheric pressure is calculated by:

$$S_p = 1.14 (P_n - P_o) (1 - e^{-R/r}) \quad \text{EQ. 3-85, SPM } \underline{1/}$$

$$P_n = 29.92 \text{ inches}$$

$$P_o = 27.47 \text{ inches}$$

$$R = 20 \text{ nautical miles}$$

$$r = 1 \text{ nautical miles}$$

$$S_p = 3.1 \text{ feet}$$

d. STORM SURGE ( $S_s$ ).

The water level rise due to storm surge is calculated by:

Storm surge =  $S_i$ , which is the incremental rise in water level due to wind stress perpendicular to the bottom contour.

$$S = \frac{540K U_R^2 X}{\bar{d}} \quad (\text{TR-4, 1-64}) \underline{2/}$$

$$X = \text{total distance in N.M.}$$

$$K = 3.0 \times 10^{-6}$$

$$U_R = 62 \text{ knots}$$

$$X = \text{incremental distance in N.M.}$$

$$\bar{d} = \text{mean depth over increment (FT)}$$

$$d_i = \text{initial depth}$$

Storm surge in the study area is estimated at 1.2 feet.

e. WAVE SETUP,  $S_w$ . Wave setup is estimated from calculated theoretical values, considering that the location of the primary protective structure is not in the zone of maximum wave setup. Under certain wave conditions, the structure may be in a zone of wave setdown, resulting in a relatively lower water level. For engineering calculations, a value of 0.5 feet is selected for  $S_w$ .

1/ US Army Coastal Research Center, Shore Protection Manual, 3d Edition, 1977.  
2/ US Army Coastal Research Center, Technical Report No. 4, 3d Edition, 1966.

f. DESIGN STILLWATER LEVEL. The design stillwater level (SWL) is defined as the level of water above the elevation datum plane, when no waves are present. Components of the SWL are astronomical tide level ( $S_a$ ), atmospheric pressure drop ( $S_p$ ), storm surge ( $S_s$ ), and wave setup ( $S_w$ ). Stillwater level components are calculated as follows; assuming the components are additive functions.

SWL = Design still water level

SWL =  $S_a + S_p + S_s + S_w$

SWL = 2.4' + 3.1' + 1.2' + 0.5'

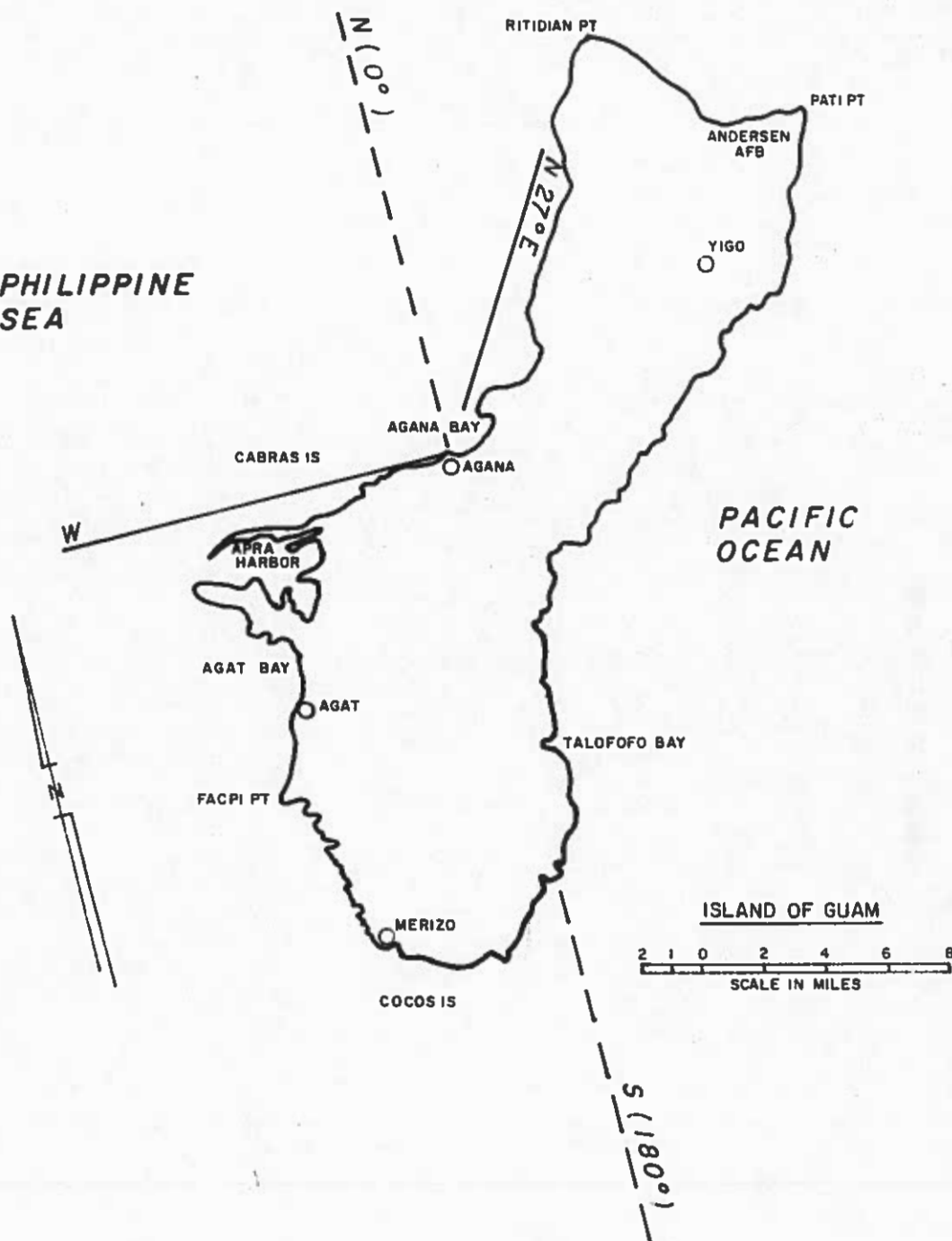
SWL = 7.2 feet

#### WAVE CLIMATE

The study area is sheltered by the island mass from the prevailing easterly waves. The geometric exposure to deepwater waves, assuming a straight line approach, is from approximately west clockwise to north-northeast. Figure D-2 depicts the exposure to deepwater waves, and Figure D-3 shows the surface winds. Hindcasts of tropical storms and typhoons in the Western North Pacific during the period 1975-1979 were performed and the number of hours of wave activity affecting Guam within given wave height, direction, and period classes were cumulated. Yearly statistics were developed by dividing by the number of hours in the year and converting to percent. This data indicates a greater incidence of waves approaching from the exposed sector than indicated by data contained in the Summary of Synoptic Meteorological Observations (SSMO) prepared by the National Climatic Center.

The SSMO data, obtained through direct synoptic observation by shipboard personnel, represents average local wind wave conditions (sea), while the hindcasted storm wave data represents storm generated waves (swell). Table D-1 summarizes the annual percent of occurrence of deepwater wave height versus direction and Table D-2 summarizes the annual percent of occurrence of wave period versus direction for the project site. The data represents only the percent of occurrence for the directions south clockwise to north, but does not preclude the percentage of time when deepwater waves approach Guam from other directions. Simultaneous occurrence of local wind waves from the easterly direction and storm generated swell from the westerly directions is probable.

PHILIPPINE  
SEA



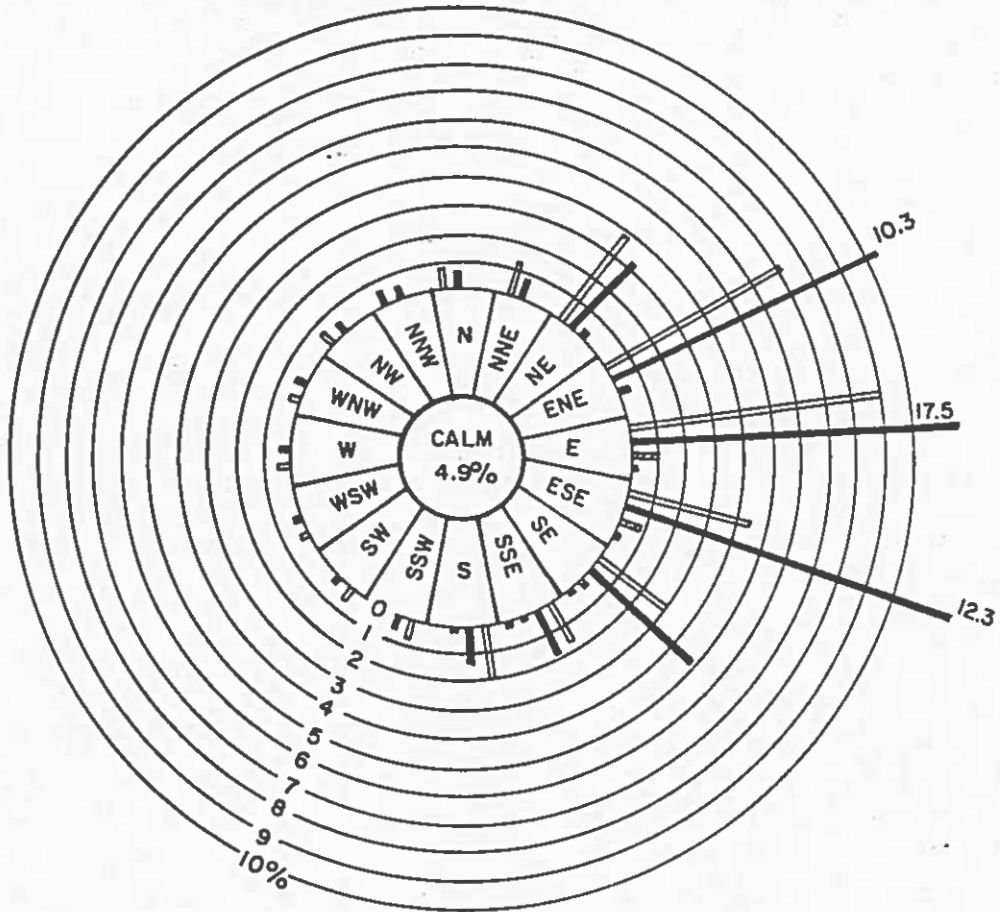
PASEO DE SUSANA SHORE PROTECTION  
AGANA, GUAM

DEEPWATER WAVE EXPOSURE

U. S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE D-2

**SURFACE WIND DIAGRAM**  
**AGANA FIELD FLEET WEATHER CENTRAL**  
**GUAM, MARIANA ISLANDS**



**LEGEND**

- 1-6 KNOTS
- 7-16 KNOTS
- 17-21 KNOTS
- OVER 21 KNOTS

CONVERSION: 1 KNOT = 1.1516 MPH

10% = TOTAL % OF THE YEAR

PERIOD OF RECORD

1945-1967

SOURCE

NATIONAL WEATHER SERVICE  
 HONOLULU, HAWAII  
 DATA COMPILED BY U.S. AIR FORCE  
 ENVIRONMENTAL TECHNICAL  
 APPLICATION CENTER,  
 ASHEVILLE, N.C.

PASEO DE SUSANA SHORE PROTECTION  
 AGANA, GUAM

**SURFACE WIND DIAGRAM**

U.S. ARMY ENGINEER DISTRICT, HONOLULU

TABLE D-1

ANNUAL PERCENT OF OCCURRENCE OF WAVE HEIGHTS-<sup>1/</sup>  
VERSUS DIRECTION

| WAVE<br>HEIGHT<br>(FT) | WAVE DIRECTION (FROM WHICH WAVES APPROACH) |                          |           |             |          |            |           |             |          |            | TOTAL |
|------------------------|--------------------------------------------|--------------------------|-----------|-------------|----------|------------|-----------|-------------|----------|------------|-------|
|                        | S<br>SEA <sup>2/</sup>                     | S<br>SWELL <sup>3/</sup> | SW<br>SEA | SW<br>SWELL | W<br>SEA | W<br>SWELL | NW<br>SEA | NW<br>SWELL | N<br>SEA | N<br>SWELL |       |
| 0-2                    | 2.0                                        | 0.1                      | 1.8       | 0.3         | 1.9      | 6.5        | 1.2       | 9.4         | 2.9      | 2.7        | 28.8  |
| 2-4                    | 1.5                                        | 0                        | 2.1       | 0           | 0.9      | 3.1        | 0.5       | 4.1         | 2.1      | 1.5        | 15.8  |
| 4-6                    | 0.8                                        | 0                        | 0.8       | 0           | 0.5      | 2.2        | 0.3       | 3.3         | 1.5      | 2.1        | 11.5  |
| 6-8                    | 0.7                                        | 0                        | 0.9       | 0           | 0.5      | 1.7        | 0.1       | 2.3         | 0.9      | 1.1        | 8.2   |
| 8-10                   | 0.1                                        | 0                        | 0         | 0           | 0        | 1.5        | 0         | 1.7         | 0.1      | 0.8        | 4.2   |
| 10-12                  | 0                                          | 0                        | 0.1       | 0           | 0.2      | 1.8        | 0         | 1.7         | 0.1      | 0.4        | 4.3   |
| 12-14                  | 0.1                                        | 0                        | 0.1       | 0           | 0.1      | 0.4        | 0         | 0.7         | 0.1      | 0.5        | 2.0   |
| 14-16                  | 0                                          | 0                        | 0         | 0           | 0        | 0.9        | 0         | 0           | 0        | 0          | 0.9   |
| 16                     | 0                                          | 0.5                      | 0         | 0           | 0        | 0.3        | 0         | 0.3         | 0        | 0          | 1.1   |
| TOTAL                  | 5.2                                        | 0.6                      | 5.8       | 0.3         | 4.1      | 18.4       | 2.1       | 23.5        | 7.7      | 9.1        |       |
|                        | 5.8                                        |                          | 6.1       |             | 22.5     |            | 25.6      |             | 10.8     |            | 70.8  |

<sup>1/</sup> The sea and swell are assumed to be mutually exclusive. This is conservative, as there will be some joint occurrence.

<sup>2/</sup> Data Source: Summary of Synoptic Meteorological Observations (SSMO), Hawaii and selected North Pacific island coastal marine areas, Volume 5, Area 15, prepared by the National Climatic Center.

<sup>3/</sup> Data Source: Hindcasts of tropical storms and typhoons in the Western North Pacific, 1975-1979, based on data obtained from Annual Typhoon Reports published by US Fleet Weather Central.

TABLE D-2

ANNUAL PERCENT OF OCCURRENCE OF STORM WAVE PERIOD  
VERSUS DIRECTION<sup>1/</sup>

| WAVE PERIOD (Sec) | S | SW  | W    | NW   | N    | TOTAL |
|-------------------|---|-----|------|------|------|-------|
| 0-6               | 0 | 0.3 | 11.4 | 18.0 | 6.9  | 36.6  |
| 6-8               | 0 | 0   | 3.1  | 4.5  | 1.6  | 9.2   |
| 8-10              | 0 | 0   | 1.8  | 4.0  | 2.1  | 7.9   |
| 10-12             | 0 | 0   | 2.4  | 3.8  | 2.1  | 8.3   |
| 12-14             | 0 | 0   | 4.0  | 5.2  | 1.8  | 11.0  |
| 14-16             | 0 | 0   | 2.4  | 2.9  | 1.4  | 6.7   |
| 16-18             | 0 | 0   | 1.1  | 1.8  | 0.8  | 3.7   |
| Over 18           | 0 | 0.2 | 2.4  | 2.3  | 0.8  | 5.7   |
| TOTAL             | 0 | 0.5 | 28.6 | 42.4 | 17.6 | 89.1  |

<sup>1/</sup> Data Source: Hindcasts of tropical storms and typhoons in the western North Pacific, 1975-1979, based on data obtained from Annual Typhoon Reports published by the US Fleet Weather Central.

## DESIGN WAVE HEIGHTS

Based on the wave climate data, the highest one percent of waves affecting the site have a height of 16 feet and a period of 16 seconds. Since the structures would be located on the reef flat, the design of the structural elements was based on controlling depth criteria to determine the maximum wave height to which a structure might reasonably be subjected.

Because of the wide, fringing reef fronting Agana Bay, the large incident waves will break completely seaward of the structures since they are located well landward of the reef edge. The maximum wave on the inner reef flat is 6.4 feet based on a controlling depth of 8.2 feet, and a slope,  $M = 0.06$ .

The reef gap at the mouth of the Agana Harbor entrance channel and the protective structures at the harbor entrance provide a double diffractive effect on incident waves propagating into the harbor entrance channel. Based on previous analysis performed for similar projects and model studies, it is estimated that incident wave heights will be reduced by 50% before reaching the harbor entrance. Based on an entrance channel depth of 15 feet and maximum still water level of 7.2 feet, it is assumed that the maximum wave incident to the channel entrance is a reformed wave of 16 feet. Therefore, the maximum wave at the harbor entrance would be 8.5 feet. The Agana Harbor design analysis indicates that wave diffraction around the structures at the

harbor entrance will reduce wave heights to levels between 0 feet at the landward end of the existing Corps wave absorber and 2 feet at the Agana Marina. A design wave height of 4.0 feet is used for structures along the Agana Harbor shore of the park.

## PROTECTIVE STRUCTURES DESIGN

Stability Requirements. The Coastal Engineering Research Center's (CERC) Shore Protection Manual (SPM) design formulas were used to determine the weight of the stones and the thickness of the stone layers required for stability. The following factors were used in the armor layer design computations:

|                                                      |          | <u>East Revetment</u> | <u>West Revetment</u> |
|------------------------------------------------------|----------|-----------------------|-----------------------|
| Unit weight of stone, pcf:                           | $W_r$    | 147                   | 147                   |
| Design wave height, feet:                            | $H_D$    | 6.4                   | 4.0                   |
| Stability coefficient:                               | $K_D$    | 3.5                   | 4.0                   |
| Specific gravity of armor unit relative to seawater: | $S_r$    | 2.3                   | 2.3                   |
| Cotangent of structure slope:                        | $\cot a$ | 1.5                   | 1.5                   |
| Layer coefficient:                                   | $k$      | 1.15                  | 1.15                  |
| Layer thickness:                                     | $n$      | 2                     | 2                     |

Armor stone size:

$$W = \frac{W_r H_D^3}{K_D (S_r - 1)^3 \cot a}$$

An acceptable range of armor stone size is generally  $\pm 25\%$  of the calculated weight.

$$\text{Armor layer thickness} = nk \frac{(W)^{1/3}}{(W_r)^{1/3}}$$

The underlayer stone size is based on approximately one tenth the weight of the armor stone and the underlayer thickness was calculated using the layer thickness formula. The bedding layer is based on 1/400 the weight of the armor stone graded to minimize piping of the fill material which is being protected. The bedding layer thickness is set at a minimum of 1.5 feet for constructibility purposes. Table D-3 summarizes the stone weight and layer thickness required for stability.

TABLE D-3 - STONE WEIGHT AND LAYER THICKNESS

| <u>Revetment Type</u> | <u>Stone Weight<br/>(pounds)</u> | <u>Layer Thickness<br/>(feet)</u> |
|-----------------------|----------------------------------|-----------------------------------|
| East Revetment        |                                  |                                   |
| Armor                 | 2,500-4,000                      | 6.5                               |
| Underlayer            | 200-400                          | 3.0                               |
| Bedding Layer         | 1-50                             | 1.5                               |
| West Revetment        |                                  |                                   |
| Armor                 | 500-1,000                        | 4.1                               |
| Underlayer            | 50-100                           | 2.0                               |
| Bedding Layer         | 1-50                             | 1.5                               |

The crest width was calculated using the same formula for determining armor layer thickness and a 3-stone crest width,  $n = 3$  and  $k = 1.15$ :

$$\text{Crest width} = nk \frac{(W)^{1/3}}{(W_r)}$$

This calculation yields a crest width of 10 feet for the east shoreline revetment. Using  $n = 6$  and  $k = 1.15$  for the west shoreline yields a calculated crest width of 12 feet.

Runup and crest elevations. The maximum runup occurs when the incident wave crests approach parallel to the structure. When the wave strikes at an angle to the structure, the effective surface area available for wave energy dissipation is increased, thereby decreasing the wave runup. Based on the refraction analysis for the Agana Harbor, incident waves will strike the east shoreline of the Paseo de Susana at an angle of 68 degrees or greater from normal to the shoreline. Therefore, a wave striking a structure with a 1V on 1.5H slope at this location will run up on an effective slope of 1V on 4H or flatter. Based on the diffraction analysis for the Agana Harbor, waves will travel up the harbor entrance channel and diffract around the harbor structures, striking the west shoreline at an angle of approximately 58 degrees from normal. Waves striking a structure at this location with a 1V on 1.5H slope will runup on an effective slope of 1V on 3H.

The runup computations were based on criteria contained in the SPM and further refined by data contained in CERC's Coastal Engineering Technical Aid (CETA) publications 78-2 and 79-1 and data obtained from model tests conducted for similar structures. Based on a breaking wave height of 6.4 feet, wave period of 8 seconds, stillwater level of +7.2 feet MLLW, and an effective side slope of 1V on 4H, the runup was computed at 4.2 feet. The non-overtopping crest elevation would be equal to the runup plus stillwater level, or 11.4 feet. The runup based on a nonbreaking wave height of 4.0 feet, wave period of 8 seconds, stillwater level of +7.2 feet MLLW, and effective side slope of 1V on 3H, was computed at 3.1 feet. The non-overtopping crest elevation would be equal to the runup plus stillwater level, or 10.3 feet.

Taking into consideration the aesthetics and desirability of an unrestricted view of Agana Bay for the park users, as well as the inland location of the nearest potentially damageable park structures, it is desirable to minimize the crest elevation of any protective structure placed along the park shoreline. The crest elevation of the east shoreline revetment was set at +10 feet to match that of both the existing revetment and wave absorber. The crest elevation of the west shoreline revetment was set at +7 feet to roughly correspond to the average elevation of the backshore land.

At these crest elevations, the 6.4-foot design wave will overtop the east revetment by 1.4 feet, and the 4.0-foot design wave will overtop the west revetment by 3.3 feet. In order to mitigate the effects of these levels of overtopping, the east revetment 200-400 pound underlayer stones are extended 10 feet inland beyond the armor layer, and the west revetment crest width is set at 6 armor stones or 12 feet for absorption of the overtopping wave energy.

APPENDIX D

SECTION 11. COST ESTIMATES

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# 1. BASIS FOR ESTIMATE

- a. A Guam-based contractor will perform the construction.
- b. Blasting and excavation of reef rock will not be required.
- c. Revetment stone and quarry run is priced from the Hawaiian Rock Products quarry.
- d. Fill for Plan 3 will be from excavated material.
- e. Construction Period:
  - (1) Plan 1 12 months
  - (2) Plan 2 10 months
  - (3) Plan 3 9 months
- f. Costs based on November 1983 price levels.
- g. Lands required for improvements are all park lands, owned by Government of Guam; therefore, no economic costs for lands are shown in this estimate.
- h. Engineering and design cost does not include \$120,000 for preauthorization study.

# 2. ESTIMATE OF FIRST COSTS

## a. Plan 1

### (1) Construction

|                                     | Quantity   | Unit Cost<br>\$ | Item Cost<br>\$ | Total Cost<br>\$ |
|-------------------------------------|------------|-----------------|-----------------|------------------|
| Mobilization and Demobilization     | 1          | Job             | \$30,000        |                  |
| Revetment                           |            |                 |                 |                  |
| Excavation                          | 14,500 cy  | \$7.70          | 111,700         |                  |
| Armor Stones                        |            |                 |                 |                  |
| 1.25 - 2.0 tons                     | 4,800 tons | 41.00           | 196,800         |                  |
| 500 - 1,000 lbs                     | 7,820 tons | 41.00           | 320,600         |                  |
| Underlayer Stones                   |            |                 |                 |                  |
| 200 - 500 lbs                       | 2,120 tons | 31.00           | 65,700          |                  |
| 50 - 100 lbs                        | 3,870 tons | 31.00           | 120,000         |                  |
| Bedding spalls to 50 lbs            | 8,420 tons | 27.00           | 227,300         |                  |
| Contingency                         | 25%        |                 | 267,900         |                  |
| Total Direct Construction Cost      |            |                 |                 | \$1,340,000      |
| (2) Engineering and Design          |            |                 |                 | \$66,000         |
| Plans & Specs                       |            | \$60,000        |                 |                  |
| Engineering During Construction     |            | 6,000           |                 |                  |
| (3) Supervision and Administration  |            |                 |                 | \$94,000         |
| TOTAL ESTIMATED FIRST COST - PLAN 1 |            |                 |                 | \$1,500,000      |

b. Plan 2

(1) Construction

|                                 | <u>Quantity</u> | <u>Unit Cost</u><br>\$ | <u>Item Cost</u><br>\$ | <u>Total Cost</u><br>\$ |
|---------------------------------|-----------------|------------------------|------------------------|-------------------------|
| Mobilization and Demobilization | 1               | Job                    | \$30,000               |                         |
| Revetment                       |                 |                        |                        |                         |
| Excavation                      | 14,500 cy       | \$7.70                 | 87,800                 |                         |
| Armor Stones                    |                 |                        |                        |                         |
| 1.25 - 2.0 tons                 | 4,800 tons      | 41.00                  | 196,800                |                         |
| 500 - 1,000 lbs                 | 4,910 tons      | 41.00                  | 201,300                |                         |
| Underlayer Stones               |                 |                        |                        |                         |
| 200 - 500 lbs                   | 2,120 tons      | 31.00                  | 65,700                 |                         |
| 100 - 200 lbs                   | 2,430 tons      | 31.00                  | 75,300                 |                         |
| Bedding spalls to 50 lbs        | 6,430 tons      | 27.00                  | 173,600                |                         |
| Contingency                     | 25%             |                        | <u>207,500</u>         |                         |
| Total Direct Construction Cost  |                 |                        |                        | \$1,038,000             |

(2) Engineering and Design

\$65,000

Plans & Specs \$60,000  
Engineering During Construction 5,000

(3) Supervision and Administration

\$72,000

TOTAL ESTIMATED FIRST COST - PLAN 2

\$1,175,000

c. Plan 3

(1) Construction

|                                             | <u>Quantity</u> | <u>Unit Cost</u><br>\$ | <u>Item Cost</u><br>\$ | <u>Total Cost</u><br>\$ |
|---------------------------------------------|-----------------|------------------------|------------------------|-------------------------|
| Mobilization and Demobilization             | 1               | Job                    | \$30,000               |                         |
| Revetment                                   |                 |                        |                        |                         |
| Armor Stones                                |                 |                        |                        |                         |
| 1.25 - 2.0 tons                             | 4,800 tons      | 41.00                  | 196,800                |                         |
| 500 - 1,000 lbs                             | 2,568 tons      | 41.00                  | 105,300                |                         |
| Underlayer Stones                           |                 |                        |                        |                         |
| 200 - 500 lbs                               | 2,120 tons      | 31.00                  | 63,600                 |                         |
| 100 - 200 lbs                               | 1,185 tons      | 31.00                  | 36,700                 |                         |
| Bedding spalls to 50 lbs                    | 5,717 tons      | 27.00                  | 154,400                |                         |
| Fill                                        | 1,000 CY        | 12.00                  | 12,000                 |                         |
| Beach Morning Glory<br>(Plants @ 5 ft o.c.) | 30,000 SF       | 0.50                   | 15,000                 |                         |
| Contingency                                 | 25%             |                        | <u>153,200</u>         |                         |
| Total Direct Construction Cost              |                 |                        |                        | \$767,000               |

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Total Direct Construction Cost (brought forward) | \$767,000       |
| (2) Engineering and Design                       | \$65,000        |
| Plans & Specs                                    | \$60,000        |
| Engineering During Construction                  | 5,000           |
| (3) Supervision and Administration               | <u>\$54,000</u> |
| TOTAL ESTIMATED FIRST COST - PLAN 3              | \$886,000       |

#### MAINTENANCE COSTS:

Costs to maintain the structures are based on analyses and assuming that approximately 20% of the structure would require repairs once in 8 to 10-year intervals. Using an 8-1/8% interest, present worth factors and 1983 cost factors, the following annual maintenance costs for the revetment portions of the plans are estimated:

|                          |         |
|--------------------------|---------|
| Plan 1                   | \$5,200 |
| Plan 2                   | \$4,000 |
| Plan 3                   | \$3,000 |
| (Revetment portion only) |         |

Additional cost to maintain the planted slopes of Plan 3 is estimated at \$12,000 annually for the life of the project including plant replacement, trimming, fertilizing and general maintenance. A total estimated annual maintenance for Plan 3 is \$15,000.

#### INTEREST DURING CONSTRUCTION:

Interest during construction (IDC) for the estimated first cost (P) is computed at a rate of 8-1/8% (i) where  $IDC = P[(1+i)^n - 1]$ . The construction period, n, varies for the three plans evaluated. The computed IDCs are as follows:

|                         | <u>Plan 1</u> | <u>Plan 2</u> | <u>Plan 3</u> |
|-------------------------|---------------|---------------|---------------|
| Estimated First Cost, P | \$1,500,000   | \$1,175,000   | \$886,000     |
| Construction Period, n  | 1.0           | 0.83          | 0.75          |
| $[(1+i)^n - 1]$         | .08125        | .06726        | .0634         |
| IDC                     | \$122,000     | \$79,000      | \$56,000      |

## APPENDIX D

### SECTION III. GEOLOGY, FOUNDATIONS AND MATERIALS

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### III. GEOLOGY, FOUNDATIONS AND CONSTRUCTION MATERIALS

REGIONAL GEOLOGY. Guam is the southernmost and largest island of the Mariana Islands. This group of limestone and volcanic islands are located in the western Pacific Ocean roughly 1,200 miles east of the Philippine Islands and 1,300 miles south of Japan. The Mariana Island chain forms the high (land) points of the submerged Marianas Ridge separating the Philippine Sea from the Pacific Ocean. The Marianas Ridge was uplifted from the ocean floor as a result of rock masses beneath the Pacific Ocean being thrust under rock masses of Philippine Sea. The zone of underthrust or subduction is called the Mariana Trench and is located 70 miles east and southeast of Guam. Consequently, the Mariana Islands have experienced a geologic history rich in seismic activity and volcanism. Although volcanic activity has been absent on Guam since the Miocene epoch of geologic time (21 million years ago), it continues to the present in the north Mariana Islands. The shallow seas created by uplift and volcanism and having been warmed as a result of the 10° to 20° latitude of the Marianas Ridge have made ideal conditions for extensive coral growth.

Two geomorphic provinces make up Guam. The north half of the island is a coralline limestone plateau which has grown as a thin mantle on thick volcanic deposits. The south portion of the island is composed primarily of volcanic rocks (ash deposits, tuffs and weathered lava basalts). Both geomorphic provinces of Guam have fringing reefs.

SITE GEOLOGY. Paseo de Susana Park is located on the southwestern side of the Limestone Plateau (north) geomorphic province of Guam. The park consists of fills derived, at least in part, from the post-war reconstruction. The park is a triangular shaped peninsula with the base abutting the shoreline of the City of Agana and the apex pointing north into Agana Bay. The fills cover a fringing reef and beach deposits. On the east side of the park, the Agana River empties onto the reef and into Agana Bay. The west edge of the park borders the channel for the Agana Small Boat Harbor (located west of the base of the triangular shaped peninsula). A 225-foot breakwater extending north from the apex of the peninsula and 250-foot wave absorber near the Agana channel entrance are two features constructed at Paseo de Susana Park as part of the Agana Small Boat Harbor project. The Agana (SBH) Channel is suspected of being the former channel for the Agana River. Construction of Paseo de Susana Park diverted the Agana River away from the original channel. The ancient river channel through the fringing reef was formerly used as a mooring facility and natural harbor for Agana's fishing industry.

As previously mentioned, Paseo de Susana Park is founded on fringing reef. Borings made for the Agana Small Boat Harbor show the outer reef to consist of hard to moderately hard coral limestone and limestone breccia and the surface of the inner reef to consist of unconsolidated clastic sediments (calcareous sand). Although sand-filled vugs and voids can occupy up to 50% of the total volume of reef rock, the reef generally has good strength characteristics. No failures in the foundation of breakwaters, sewage treatment plant, wave absorbers and revetted causeway around the Agana Small Boat Harbor have been observed or reported.

The fill materials which make up Paseo de Susana Park consist of silty coral-line sand, gravel, cobbles and boulders mixed with concrete and steel debris. Subsurface materials covering the shorelines in the areas of improvements are shown on the Geologic Map, Figure 1 and Generalized Cross Sections, Figures 2 and 3. Cross sections were developed from field observations made of the surface materials. Materials at depth and their horizontal and vertical attitudes are assumed (based upon Agana Small Boat Harbor borings). The sections show generally good toe foundation conditions for proposed shore protection structures exist over nearly all of the west side of the park and over at least half of the east side. Some minor dredging for the toe of breakwaters may be required on the east side of the park.

#### SUBSURFACE INVESTIGATIONS

No subsurface exploration relative to the proposed shore protection project was conducted during this phase of study. Information from the Agana Small Boat Harbor supported with field observations have been used to develop the geotechnical data presented within this report. The need remains to verify toe-foundation conditions for the proposed shore protection. Such an exploratory investigation shall require a minimum of four (4) core holes for improvements on both east and west sides of Paseo de Susana Park. The exploratory holes shall extend to a maximum depth of 20 feet unless at least 10 feet of rock core is recovered to define the limits of materials suitable for the founding of shore protection structures. Borings would not be required for the west shoreline component of Plan 3.

#### SEISMICITY

The seismic regime of Guam has been well documented. A tabulation obtained from the Guam observatory lists 83 earthquakes of magnitudes 6 and greater which occurred between 1902 and 1975. From the total years of record, two earthquakes with an intensity of VIII to IX have occurred. Since the area is seismically active, it is reasonable to assume that earthquakes of this intensity will occur again. Government Design Manual TM 5-809-10, dated February 1982, indicates Guam is located in seismic probability Zone 3. For design purposes, maximum acceleration of 0.33g should be used with a corresponding approximate earthquake magnitude of 7 on the Richter scale. Gutenberg and Richter (1954) report magnitudes for earthquakes between 1904 and 1950. Four of these are significant, occurring in 1912, 1932, and October and November 1936. Magnitudes were in the range of 6 to 7 and focal depths were in the range of 60 to 70 kilometers. The most recent significant earthquakes occurred in November 1, 1975. The reported magnitude was in the range of 6 to 7 and the depth is reported as 113 kilometers. It was centered a few kilometers north of Guam. All of the significant earthquakes, for which focal depth estimates are available, indicate that the active zone is the underthrust which is believed to dip eastward at about 45 degrees beneath the island.

The seismic observatory on Guam does not have strong motion recording equipment. For dynamic analyses, which requires an earthquake spectrum, spectra from seismically active areas will have to be reviewed and modified for the geologic conditions on Guam.

## SOURCES OF CONSTRUCTION MATERIALS

Rocks for construction purposes are generally mined in the northern half of Guam because of their high quality and availability. The thick layer of soil and earthly residual deposits over most of the southern half of the island preclude the possibility of finding and developing igneous rocks for construction purposes. Commercial sources of rock which is suitable for revetment purposes are summarized as follows:

Hawaiian Rock Products. This company owns and operates the largest quarry on Guam. It is located off highway 15 at Taguan Point in Barrigada approximately 10 miles from Paseo de Susana Park. Rock from this quarry was used to construct breakwaters for the Agana Small Boat Harbor. The rock available from this quarry consists of compact, recrystallized massive coral limestone and limestone breccia. It breaks in angular blocks with sizes up to 20 ton pieces. Its bulk specific gravity ranges from 2.3 to 2.5. Rock from this quarry appears to be the most suitable source of revetment rock on Guam.

Perez Brothers. This company operates several quarries on Guam mainly for the purpose of fill materials and road base-course materials. Of these quarries, only the quarry at Barrigada (near Hawaiian Rock Products quarry) is capable of producing large size rock for revetment. Rock from this quarry is similar to the rock produced at the Hawaiian Rock Products quarry (located 1 mile north) since both are taken from the same limestone formation. This quarry is located approximately 9 miles from the project. This quarry was formerly called the Fadian Point Quarry and was previously owned and operated by the Government of Guam.

Hyundai Quarry. This quarry is small, locally owned and is operated as the demand for materials dictates. The rock is generally of the same quality as the two previous quarries mentioned since it is also within the same geologic formation. The quarry is located near Mount Santa Rosa on Highway 15, approximately 15 miles from the project site.

Cabras Island. Although this is not a commercial quarry, it is important to mention that this quarry contained the source rock for the Glass Breakwater at Apra Harbor. The rock quality of Cabras Island is considered good, however, the quarry is reserved for future development by the U.S. Navy for maintenance of the Glass Breakwater and other uses.

## UNDEVELOPED SOURCES

Large pieces of armor rock could be quarried near the coast in cliff tops at Orote Point, Amantis Point, Taguan Point, and at several other cliff-headed lands. Development of quarries at these locations may be economical if large quantities of rock are required. The potential armor rock is massive, compact, recrystallized coral limestones which will require drilling and blasting for excavation.

PASEO DE SUSANA SHORE PROTECTION  
TERRITORY OF GUAM

ECONOMIC ANALYSIS

APPENDIX E  
ECONOMIC ANALYSIS

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## GENERAL

Benefits credible to Paseo shore protection result from an increase in the quality of recreation activity and preventing damage to trees. Benefits are the measured difference between conditions with and without a shore protection project and are expressed as an equivalent annual value, using projected annual visits and judgment factor matrix point scores.

## PROJECTION OF PARK VISITS

Projections of annual visits to the Paseo multi-purpose recreational park were made using records of counts from permits, interviews, and field counts. Visitors were projected in two categories, the local residents and the tourist visitors. Development of the park use for the 50-year period beginning at the base year 1985 and extending to 2035 is presented in the following paragraphs:

Park Use Activities - Paseo Park is the recreational center of Guam, offering nearly all of the facilities for active and passive recreation. The park is circumferenced by a large grassed area, has a ball park area, and an area for indoor sports. A list of popular activities (Table E-1) was gathered during recent interviews with the park administration. Popular park features are shown in the Main Report, Figure 2.

TABLE E-1. LIST OF POPULAR ACTIVITIES AT PASEO PARK

|              |               |                          |                     |
|--------------|---------------|--------------------------|---------------------|
| Picnic Area  | Fairground    | Cultural Art Classes     | School Excursions   |
| Scenic Site  | Clubhouse     | Shoreside Fishing        | Major League Camp   |
| Concession   | Public Market | Net Fishing              | Boat Basin Channel  |
| Softball     | Chief Quipuha | Liberation Day Festival  | Volleyball          |
| Stadium Site | Segandinana   | 4th July Festival        | Lineman Trng Ground |
| Basketball   | Meeting Place | Mini Soccer              | Bicycling           |
| Boxing       | Pavilion      | Mini Hockey              | Commissioner's Ofc  |
| Jogging      | Parking Area  | Marathon Begin & End Pts | Recreational Div HQ |

Field Survey of Visitors - A field survey of use of the park periphery (grounds adjacent to the shoreline) was conducted in late April of 1982. During the four-day period, morning, noon and afternoon hours of the day were chosen for tabulation. Results indicate heaviest use of this area during the late morning, and the afternoon hours. All tour buses stop at this park, with all visitors from the buses spending some time at the shoreline. Table E-2 summarizes results of the field survey.

TABLE E-2. FIELD SURVEY OF VISITORS USING PARK GROUNDS  
ADJACENT TO SHORELINE

| <u>Date</u>      | <u>Time</u>                | <u>Parked<br/>Cars</u> | <u>Tour<br/>Buses</u> | <u>Local<br/>Residents</u> | <u>Tourists</u>   | <u>Flea<br/>Market<br/>Customers</u> | <u>Maint<br/>Workers</u> | <u>Others</u>  |
|------------------|----------------------------|------------------------|-----------------------|----------------------------|-------------------|--------------------------------------|--------------------------|----------------|
| Apr 2<br>(Tues)  | 8:50 AM                    | 28                     | 0                     | 3                          | 12                | 10                                   | 0                        | 0              |
|                  | FR 10:10 AM<br>to 11:30 AM | 30                     | 18                    | 42                         | 738 <sup>1/</sup> | 17                                   | 1                        | 6<br>(surfers) |
|                  | 4:30 PM                    | 22                     | 0                     | 66                         | 8                 | 0                                    | 0                        | 0              |
| Apr 28<br>(Wed)  | 6:10 AM                    | 4                      | 0                     | 2                          | 0                 | 0                                    | 0                        | 0              |
|                  | 5:30 PM                    | 31                     | 0                     | 83                         | 8                 | 6                                    | 1                        | 4<br>(surfers) |
| Apr 29<br>(Thur) | 9:00 AM                    | 26                     | 0                     | 6                          | 2                 | 14                                   | 0                        | 3<br>(surfers) |
| Apr 30<br>(Fri)  | 6:30 AM                    | 6                      | 0                     | 0                          | 0                 | 0                                    | 0                        | 0              |
|                  | 8:00 AM                    | 15                     | 0                     | 0                          | 0                 | 8                                    | 0                        | 5<br>(surfers) |

<sup>1/</sup> The average bus carries 41 passengers.

Visits by Local Population - Estimated counts of visitors to Paseo Park by the local population were based on interviews with the Recreation Administrators of Guam and custodians at the park. There are no records kept of daily count of visitors to the park. Estimates were based on permits issued for special events, scheduled events not requiring permits, patterns of family visits, and visual observation. An estimate of all local visits to the park was calculated, however, only those visits to park grounds at or adjacent to the shoreline are considered. An annual estimate of 230,000 visits (73,000 + 157,123 = 230,000) in 1982 from Table E-3 is considered for the benefit analysis.

TABLE E-3. ESTIMATED ANNUAL VISITS TO PASEO PARK  
BY LOCAL POPULATION IN 1982

| <u>Source</u>                     | <u>Shoreside<br/>Areas</u> | <u>Baseball<br/>Park</u> | <u>Other<br/>Park<br/>Facilities</u> | <u>Other<br/>Activities</u> |
|-----------------------------------|----------------------------|--------------------------|--------------------------------------|-----------------------------|
| Recreation Offices                |                            |                          | 1,300                                |                             |
| Commissioners Office              |                            |                          | 2,600                                |                             |
| Paseo Open Stadium                |                            | 55,504                   |                                      |                             |
| Softball                          |                            | 8,344                    |                                      |                             |
| Tennis Court Area                 |                            |                          | 3,972                                |                             |
| Boxing Arena                      |                            |                          | 4,660                                |                             |
| Carnival Grounds                  |                            | 42,000                   |                                      |                             |
| Farmers' Market                   |                            |                          | 109,534                              |                             |
| Voting Poll                       |                            |                          | 1,251                                |                             |
| Boat Basin                        |                            |                          |                                      | 27,415                      |
| Jogging                           | 18,250                     |                          |                                      |                             |
| Job Testing                       |                            | 2,000                    |                                      |                             |
| Pavilion                          |                            |                          | 11,300                               |                             |
| Chief Quipuha Statue              |                            |                          | 3,650                                |                             |
| Statue of Liberty Replica         | 54,750                     |                          |                                      |                             |
| Picnic Area at North Park<br>Tip  |                            | 27,375 <sup>1/</sup>     |                                      |                             |
| Picnic Area Along Agana<br>Marina |                            | 21,900 <sup>1/</sup>     |                                      |                             |
| TOTAL                             | 73,000                     | 157,123                  | 138,267                              | 27,415                      |

<sup>1/</sup> Includes fishing as well as picnicking visits.

Visits by Tourists - As noted in earlier chapters, the rising Japanese investment in Guam has resulted in a phenomenal growth of the visitor industry since 1970. The estimate by the Government of Guam for 1982 is 343,000 visitors. Although growth is expected in this sector, major development of additional hotel rooms is required. Every tourist makes at least one visit to Paseo Park as it is a center of attraction to visitors.

Projected Visits to Paseo Park - In 1982, there were 230,000 visits to Paseo Park by the local population. It is projected that these visits will grow at the same rate as population growth. Projected visits by the local population are tabulated in Table E-4. In 1982, there were 343,000 visits to Paseo Park made by tourist visitors. Although this number may increase in the future, no growth is projected for this study. Total projected annual visits to Paseo Park is tabulated in Table E-4.

TABLE E-4. PROJECTED VISITS TO PASEO PARK

| <u>Year</u>                    | <u>Local<br/>Population</u> | <u>Tourists</u> | <u>Total<br/>Visits</u> |
|--------------------------------|-----------------------------|-----------------|-------------------------|
| 1982 (Historical<br>Estimates) | 230,000                     | 343,000         | 573,000                 |
| 1985                           | 238,000                     | 343,000         | 581,000                 |
| 1990                           | 253,000                     | 343,000         | 596,000                 |
| 2000                           | 290,000                     | 343,000         | 633,000                 |
| 2010                           | 298,000                     | 343,000         | 641,000                 |
| 2020                           | 305,000                     | 343,000         | 648,000                 |
| 2030                           | 313,000                     | 343,000         | 656,000                 |
| 2035                           | 317,000                     | 343,000         | 660,000                 |

#### RECREATIONAL BENEFITS

Using criteria from Principles and Guidelines, a judgment factor matrix was developed to estimate the increase in the value of recreation activity resulting from the proposed project (Table E-5). Two different point totals are derived using this judgment approach to compare the existing (without project) recreational value of Paseo Park use to the value of the park use with the proposed shoreline project.

A brief discussion of the rationale or logic applied in rating the various criteria for the assessment of recreational values follows, for with- and without-project conditions.

Recreation Experience - Under existing conditions, several general activities including picnicking, hiking, and fishing are available. In addition, there are cultural art classes of high quality value at the park. However, with shoreline stability, recreational quality unmatched by any other site on Guam will be available. Other high quality activities will be enhanced such as Guamanian cultural festivities. The improvement reflects an increase in score value for this particular criterion.

Availability of Opportunity - With or without the improvement opportunities for similar activities are within 30 minutes to an hour travel time. Therefore, there is no change in score for this criterion.

TABLE E-5. JUDGMENT FACTOR MATRIX

| Criteria                                 |                                                                                  | Judgment Factors                                                            |                                                                                             |                                                                      |                                                                    |
|------------------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------|
| a. Recreation Experience                 | Two general activities <u>3/</u>                                                 | Several general activities                                                  | Several general activities; one high quality value activity <u>4/</u>                       | Several general activities; more than one high quality activity      | Numerous high quality value activities; some general activities    |
| Total Points: 30                         |                                                                                  |                                                                             |                                                                                             |                                                                      |                                                                    |
| Point Value:                             | 0-4                                                                              | 5-10                                                                        | 11-16                                                                                       | 17-23                                                                | 24-30                                                              |
| b. Availability of Opportunity <u>7/</u> | Several within 1 hour travel time; a few within 30 min. travel time              | Several within 1 hour travel time; none within 30 min. travel time          | One or two within 1 hour travel time; none within 45 min. travel time                       | None within 1 hour travel time                                       | None within 2 hour travel time                                     |
| Total Points: 18                         |                                                                                  |                                                                             |                                                                                             |                                                                      |                                                                    |
| Point Value:                             | 0-3                                                                              | 4-6                                                                         | 7-10                                                                                        | 11-14                                                                | 15-18                                                              |
| c. Carrying Capacity <u>1/</u>           | Minimum facility development for public health and safety                        | Basic facilities to conduct activity(ies)                                   | Adequate facilities to conduct without deterioration of the resource or activity experience | Optimum facilities to conduct activity at site potential             | Ultimate facilities to achieve intent of selected alternative      |
| Total Points: 14                         |                                                                                  |                                                                             |                                                                                             |                                                                      |                                                                    |
| Point Value:                             | 0-2                                                                              | 3-5                                                                         | 6-8                                                                                         | 9-11                                                                 | 12-14                                                              |
| d. Accessibility                         | Limited access by any means to site or within site                               | Fair access, poor quality roads to site; limited access within              | Fair access, fair road to site; fair access, good roads within site                         | Good access, good roads to site; fair access, good roads within site | Good access, high standard road to site; good access within site   |
| Total Points: 18                         |                                                                                  |                                                                             |                                                                                             |                                                                      |                                                                    |
| Point Value                              | 0-3                                                                              | 4-6                                                                         | 7-10                                                                                        | 11-14                                                                | 15-18                                                              |
| e. Environmental Quality                 | Low aesthetic factors <u>5/</u> exist that significantly lower quality <u>6/</u> | Average aesthetic quality; factors exist that lower quality to minor degree | Above average aesthetic quality; any limiting factors can be reasonably rectified           | High aesthetic quality; no factors exist that lower quality          | Outstanding aesthetic quality; no factors exist that lower quality |
| Total Points: 20                         |                                                                                  |                                                                             |                                                                                             |                                                                      |                                                                    |
| Point Value:                             | 0-2                                                                              | 3-6                                                                         | 7-10                                                                                        | 11-15                                                                | 16-20                                                              |

1/ Value should be adjusted for overuse.

2/ Value for water-oriented activities should be adjusted if significant seasonal water level changes occur.

3/ General activities include those that are common to the region and that are usually of normal quality. This includes picnicking, camping, hiking, riding, cycling, and fishing and hunting of normal quality.

4/ High quality value activities include those that are not common to the region and/or Nation and that are usually of high quality.

5/ Major aesthetic qualities to be considered include geology and topography, water, and vegetation.

6/ Factors to be considered in lowering quality include air and water pollution, pests, poor climate, and unsightly adjacent areas.

7/ Likelihood of success at fishing and hunting.

8/ Intensity of use for activity.

Carrying Capacity - There are adequate facilities at Paseo Park to conduct activities without deterioration of the resource or activity experience. No change in score is indicated.

Accessibility - There is good access to, as well as good roads within the site. No change in score is indicated.

Environmental Quality - The shoreline of this park within the plan of improvement is in very poor condition. The existing shoreline is strewn with debris, and is severely eroded. A restored shoreline would enhance the overall aesthetic quality of the park and would also provide for greater safety to persons using the waterfront areas. This difference is indicated in the evaluation matrix.

The point value totals for conditions without project and with project conditions are based on the average value assigned for the judgment factor selected. The results are tabulated as follows:

| <u>Criterion</u>            | <u>Judgment Factor Score</u> |             |
|-----------------------------|------------------------------|-------------|
|                             | <u>Without</u>               | <u>With</u> |
| Recreation Experience       | 16                           | 23          |
| Availability of Opportunity | 3                            | 3           |
| Carrying Capacity           | 6                            | 6           |
| Accessibility               | 11                           | 11          |
| Environmental Quality       | <u>3</u>                     | <u>7</u>    |
| TOTAL SCORE                 | 39                           | 50          |

The point score increases from 39 to 50 by improving conditions along the park shoreline. As shown below, the point value generated by the judgment factor matrix can be from 0 to 100 and can be used as an index to estimate a change in user-day value within the currently established range of \$1.60 to \$4.80 (Water Resource Council, Principles, Standards and Procedures for Water Resources Planning (Level C) FY 1983)).

|                               |      |      |      |      |      |      |      |      |      |      |      |
|-------------------------------|------|------|------|------|------|------|------|------|------|------|------|
| Point Value                   | 0    | 10   | 20   | 30   | 40   | 50   | 60   | 70   | 80   | 90   | 100  |
| Recreation Value per User Day | 1.60 | 1.90 | 2.10 | 2.40 | 3.00 | 3.40 | 3.70 | 3.90 | 4.30 | 4.60 | 4.80 |

The existing recreational value of the park based on the judgment factor score is \$2.94 per user day. The recreational value of park with the shoreline restored and protected is \$3.40 per user day or an increase of \$0.46 per user day over the without-project conditions.

Estimated average annual recreation benefits are shown in Table E-6 based on an economic life of 50 years and a base year of 1985.

TABLE E-6. AVERAGE ANNUAL RECREATION BENEFITS

| <u>Period</u>                                                       | <u>Projected Annual Visits</u> | <u>Increment</u> | <u>Equivalent Factor</u> | <u>Average Annual Visits</u> |
|---------------------------------------------------------------------|--------------------------------|------------------|--------------------------|------------------------------|
| Base Year                                                           | 581,000                        | 581,000          | 1.00000                  | 581,000                      |
| 5                                                                   | 596,000                        | 15,000           | .86113                   | 13,000                       |
| 10                                                                  | 633,000                        | 37,000           | .48671                   | 18,000                       |
| 10                                                                  | 641,000                        | 8,000            | .21578                   | 2,000                        |
| 10                                                                  | 648,000                        | 7,000            | .08883                   | 0                            |
| 10                                                                  | 656,000                        | 8,000            | .02934                   | 0                            |
| 5                                                                   | 660,000                        | 4,000            | .00607                   | 0                            |
| Equivalent annual visits                                            |                                |                  |                          | 614,000                      |
| Average annual value (\$3.40/visit) under improved condition        |                                |                  |                          | \$2,088,000                  |
| Average annual value (\$2.94/visit) under without project condition |                                |                  |                          | \$1,805,000                  |
| Average annual recreation benefits                                  |                                |                  |                          | \$283,000                    |

DAMAGE PREVENTION BENEFITS

Eleven ironwood trees averaging thirty feet in height front the shoreline facing the harbor will be toppled and destroyed within the next 5 years if erosion continues. Two rows of seven ironwoods, averaging eight feet in height, will be lost along the eastern shore. The first row of trees will be destroyed in 10 years and the second in 15 years if erosion continues. With shoreline improvements, these trees will remain and continue to provide the shade enjoyed by visitors to the park.

Assuming replacement value per tree is \$300 each, the average annual saving due to preventing damages to trees is \$260 (rounded to thousand = \$0.00).

SUMMARY OF BENEFITS

The average annual benefits occurring from the proposed plans of improvement are summarized in Table E-7. Plan 1 and Plan 3 provide essentially comparable recreation and athletic improvements to be the same. Plan 2, however, does not upgrade some 380 feet of the 1,470 feet of shoreline which is in deteriorated condition. This is some 25% of the deteriorated shore. With Plan 2, slight erosion will continue along this 380 feet and prevent natural healing of the landscape. Therefore, the point enhancement for Plans 1 and 3 (11 point net gain) is reduced by 25% to an 8 point (rounded) net gain for Plan 2. This reduced the benefits for Plan 2 to \$206,000.

TABLE E-7. SUMMARY OF BENEFITS

| <u>Item</u>               | <u>Average Annual Benefit</u> |               |
|---------------------------|-------------------------------|---------------|
|                           | <u>Plans 1 and 3</u>          | <u>Plan 2</u> |
| Recreation                | \$283,000                     | \$206,000     |
| Damage Prevention (Trees) | <u>0</u>                      | <u>0</u>      |
|                           | \$283,000                     | \$206,000     |